MORPHOLOGY AND TAXONOMY OF ADULT MALES OF THE FAMILY COCCIDAE (HOMOPTERA : COCCOIDEA)

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CONTENTS

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SYNOPSIS

The males of 23 species (representing 19 genera) of the family Coccidae have been described and illustrated in detail and a general account of the external morphology of male Coccidae is given. A number of structures present in other male Coccoidea but not hitherto observed in the Coccidae have been recorded. The relationships of the lecanoid type of male with the margaroid and diaspidoid types have been discussed and the males of two families of the lecanoid type (Coccidae and Pseudococcidae) have been compared with each other. Within the Coccidae the males were often found to reveal different relationships from the female and a classification is suggested which differs from the classifications based on female characters. The results of this study is in accordance with recent discoveries that the characters of the male are valid at all taxonomic levels, including genera and species. Detailed keys to groups of genera, genera and species have been provided.

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INTRODUCTION

As far as the Coccidae are concerned it is true to say that this large and important family is still very inadequately known, especially as regards the interrelationships of its members. This is partly due to the fact that satisfactory preparations of the adult females can usually only be obtained from freshly moulted specimens, which are seldom available ; preparations of the old, frequently heavily sclerotized females show only a very limited number of characters and the identity of many species described from such specimens is uncertain. A few workers (Steinweden, 1929 ; Šulc, 1941 ; Bodenheimer, 1953) indicated the close relationship of a small number

of genera, but the only comprehensive classification which has so far been published, is that of Borchsenius (1957), who divided the family into 3 subfamilies, and one of the subfamilies into 2 tribes. His classification was based mainly on a small number of characters of the adult female, among which he used also the way in which the body of the female and the eggs are protected. It was considered that a study of the male would contribute substantially to our knowledge of this family and make it possible to support or modify the classification suggested by Borchsenius, just as Ghauri's work has done with regard to the Diaspididae. Thus the scope of the present work was : (i) to make a detailed study of the morphology of a representative sample of the family Coccidae ; (ii) to describe these species in detail ; (iii) to determine what characters are of taxonomic importance and on what levels they can be used, and (iv) to advance our understanding of the relationships of members within the family, and of this family with other subdivisions of the Coccoidea.

REVIEW OF THE LITERATURE

The literature pertaining to male Coccoidea has been adequately reviewed by Ghauri (1962) and one need only mention a number of papers, particularly referring to the Coccidae, that were not discussed by him or were published subsequent to his review.

An early publication, not mentioned by Ghauri, is Newstead's (1901, 1903) monograph on the British Coccoidea. Newstead described the males whenever they were available, but mentioned only the most obvious features. He pointed to the fact that the number and position of the eyes might be of generic importance. Another early paper is that of Moulton (1907), who studied the monterey pine scale, *Physokermes insignicola* (Craw). Following the pattern established by Putnam (1879), he gave equal attention to all stages and included some information on their internal anatomy. The morphology of the adult male was only briefly outlined, but special attention was given to the eyes and terminal antennal segments.

Silvestri (1919a, 1919b, 1920) published three papers dealing with *Sphaerolecanium prunastri* (Fonsc.), *Eulecanium coryli* (L.) and *Ceroplastes sinensis* D. Guerc. respectively. His descriptions and illustrations of the males lack detail, but such useful information as the number of eyes, and the structure of the genital and pregenital segments is given. These papers are included as an appendix to Leonardi's (1920) monograph on the Coccoidea of Italy. Leonardi briefly described the males of a wide variety of Coccoidea of which the following are only a few examples (names as given by Leonardi) : *Aspidiotus hederae* (Vall.), *Lichtensia viburni* Signoret, *Aclerda berlesii* Buffa, *Pseudococcus citri* (Risso), *Eriococcus auricariae* Mask., *Micrococcus silvestrii* Leon., *Trabutina leonardii* Silv. and *Ceroputo superbus* Leon. In all these descriptions only the more obvious features were mentioned, but information such as the length of the body, antennae, hind legs and wings is included.

In a paper by Smutterer (1954), the males of *Eulecanium corni* and *E. crudum* were illustrated, but not described. Kawecki's (1958b) paper on *Eulecanium coryli* (L.) also contains a brief reference to the male ; he suggested that the term " pseudohalteres " should be used for the reduced hind wings.

A number of Russian workers have given attention to male Coccidae. Hadzibejli (1955), when describing a new species (*Neopulvinaria imeretina*), gave an account of the male. Borchsenius (1957), in a monograph on the Coccidae of the USSR, included original descriptions and illustrations of the males of 11 species, short notes on others, and repeated some of the published descriptions ; he also (1960) briefly described the male from each of the families Kermococcidae, Asterolecaniidae and Aclerdidae. Bustshik & Saakjan-Baranova (1962) dealt with some aspects of the life history, morphology and internal anatomy of the male of *Coccus hesperidum*. The descriptions of these workers follow the same general pattern, i.e. the morphology is described in general terms only, but some attention is given to the details of the head, antennae, scutellum, as well as the genital and pregenital segments. The main contribution of these papers collectively, and that of Borchsenius in particular, is that they clearly show the availability of characters in the male which can be used for taxonomic purposes.

Apart from Bustshik and Saakjan-Baranova, Bielenin (1962, 1963, 1963a) also studied the internal anatomy of a male soft scale, *Parthenolecanium pomeranicum* (Kaw.).

As far as families other than the Coccidae are concerned, mention can be made here of a paper on the Aclerdidae by McConnel (1954), in which the male of the family is briefly described, with the statement that " considerable diversity of form existed among the few species available ".

As pointed out by Ghauri (1962), a new standard of detail and accuracy was reached by Theron (1958) and the latter's study should form the foundation on which any study of male Coccidae is based. Using Theron's interpretations and terminology, Giliomee (1961) gave a detailed account of the morphology of 3 species of the genus *Pseudococcus* (Pseudococcidae) ; he also studied the chaetotaxy and discussed a number of characters which can be used to separate the 3 species. One of the species (*P. maritimus* Ehrhorn) is described as consisting of two " types " which show small differences, rather smaller than those observed between the other two species of *Pseudococcus* or the interspecific differences recorded by Beardsley (1960). However, in view of Wilkey & McKenzie's (1961) finding (from a study of the females) that more than one distinct, but very similar species have been involved under the name *P. maritimus*, it now seems likely that the two " types " of male described were in fact two species.

Ghauri (1962), in an excellent paper on the males of the Diaspididae, critically examined and amended Theron's (1958) definition of the male of this family ; he studied 24 species (representing 4 tribes and 16 genera) and proved convincingly that male characters could be used at all taxonomic levels.

A few papers on male Coccoidea have appeared since the publication of Ghauri's work. Beardsley (1962) published a paper in which he described the males of another 5 species of the Pseudococcidae, including the interesting species *Puto yuccae* (Coquillet) and *Rhizoecus falcifer* Kunckel d'Herculais. Husseiny & Madsen (1962) dealt with the life history of *Lecanium kunoensis* Kuw. and included a description of the adult male. This description is very inadequate and shows that the

authors were not aware of Theron's paper. Theron (1962), in a paper on the same lines as his earlier publication, gave an account of the structure and relationships of the male of *Phenacoleachia zealandica* (Mask.) and stated that it " ostensibly belongs to the margaroid group ", showing certain similarities to the male of *Steingelia*.

MATERIAL AND TECHNIQUE

The males of 23 species, belonging to 19 genera were studied. It was found that the classification of Borchsenius (1957), based upon female characters, was not corroborated by the characters of the male, which revealed different relationships within the family. This will be discussed later and in the list below the species studied are arranged into the suggested four new groups.

The *EULECANIUM* Group

Eulecanium Cockerell, 1896.
E. tiliae (Linnaeus, 1758).
Nemolecanium Borchsenius, 1955.
N. abietis Borchsenius, 1955.
Physokermes Targioni Tozetti, 1868.
P. piceae (Schrank, 1801).
Rhodococcus Borchsenius, 1953.
R. spiraeae (Borchsenius, 1949).
Palaeolecanium Šulc, 1908.
P. bituberculatum (Targioni Tozetti, 1868).
Phyllostroma Šulc, 1942.
P. myrtilli (Kaltenbach, 1874).
Filippia Targioni Tozetti, 1868.
F. viburni (Signoret, 1873).
Ctenochiton Maskell, 1879.
C. species.
Ericerus Signoret, 1874.
E. pela (Chavannes, 1848).
Genus *A* species.
Sphaerolecanium Šulc, 1908.
S. prunastri (Fonscolombe, 1834).

The *ERIOPELTIS* Group

Eriopeltis Signoret, 1871.
E. species.
E. ?festucae (Fonscolombe, 1834).
Luzulaspis Cockerell, 1902.
L. luzulae (Dufour, 1864).

The *INGLISIA* Group

Inglisia Maskell, 1879.
I. theobromae Newstead, 1917.

The *COCCUS* Group

Coccus Linnaeus, 1758.
C. hesperidum Linnaeus, 1758.
Genus *B* species (nr. *Pulvinaria*).
Pulvinaria Targioni Tozetti, 1868.
P. ?betulae (Linnaeus, 1758).
P. acericola (Walsh & Riley, 1868).
Parthenolecanium Šulc, 1908.
P. corni (Bouché, 1844).
P. pomeranicum (Kawecki, 1954).
Ceroplastes Gray, 1830.
C. berliniae (Hall, 1931).
C. species.

The two species, Genus *A* sp. and Genus *B* sp., are apparently both new species and genera, but no definite statement can be made here as the females are still being studied. In the *INGLISIA* group only one species (*I. theobromae*) was studied in detail, but 3 specimens of another (*Ceroplastodes chiton* Green) were compared with it, and their characters used in the discussion.

Most of the species were obtained from workers all over the world, who generously made material from their collections available, or collected material specially for the purpose of this study. The specimens were usually received in 70% alcohol, but specimens of 4 species received from J. Řeháček were remounted from Swann's mountant. In most cases the material received was already identified ; unidentified material obtained from various sources was identified by K. Boratyński, G. De Lotto and D. J. Williams. The males of six species were collected by myself, one of them (*Ctenochiton* sp.) in Stellenbosch, South Africa, and the rest at the Imperial College Field Station, Sunninghill, Berks., where their habitats were known to Dr. Boratyński.

In nearly all cases, 10 specimens of each species were examined, the various measurements taken and the setae counted. For each sample the range of variation was recorded and the average calculated. The specimens were prepared for microscopic study according to the method described by Ghauri (1962). It was found, however, that 45 minutes in KOH was usually the shortest period needed to clear the specimens and often several hours were necessary for the larger specimens. Only one stain, Chlorazol Black E, was used and the specimens were stained for one hour.

In making the illustrations, the same techniques and procedure were followed as in Giliomee (1961).

In order to standardize the measurements and prevent repetition in the individual descriptions, the way in which the various structures were measured is explained in detail below (see also Text-fig. 1).

The *body length* was measured from the anterior margin of the head to the apex of the penial sheath.

The *head* exhibits no definite structure posterodorsally and its length was therefore measured from the anterior margin to the first ridge on the thorax, the pronotal ridge ; its width was measured across the genae. The external margin of the cornea is not very distinct and the internal diameter was therefore taken. *Antenna:* The length of the scape was measured along the dorsal margin, the width across the middle of the segment ; the length of the pedicel was measured from the articular process posteroventrally to the apex of the segment, and the maximum width was taken ; the width of segments III and X was measured where they are widest, but that of segments IV–IX across the middle because they are sometimes rather wider at the apex.

The length of the *thorax* was measured from the pronotal ridge to the posterior margin of the mesopostphragma (the latter was also used by Ghauri (1962) in estimating the length of the thorax of the Diaspididae). The length of the *prescutum*

was measured from the anterior margin (topographically) to the prescutal suture, without including the broad internal ridge of the latter ; the width was measured across the middle of the sclerite, including the lateral ridges. The maximum length and width of the *median membranous area* of the scutum, the length and width across the middle of the *scutellum*, and the maximum length and width of the *basisternum* (but not including the ridges) was taken. The length of the *wing* was measured from the base of the costal complex of wing veins to the tip of the wing, and the width across its maximum expansion. The length of the segments of the leg was measured as in *Pseudococcus* (Giliomee, 1961) ; the tarsus, however, was measured along the outer margin instead of the inner, the former being the more accurate. The width of each segment was measured at its maximum, with the exception of the tibia which was measured across the middle because it is usually somewhat wider at the apex.

The length of the *abdomen* was measured from the mesopostphragma to the anus, and the width across segment III. The *penial sheath* may be somewhat curved and for accuracy its length was measured in pleural view, following the curve ; its width was measured at the level of the base of the aedeagus.

The material used in this study has been deposited in the collections of the British Museum (Natural History), London, the Imperial College of Science and Technology, London and the Department of Entomology, University of Stellenbosch, South Africa.

KEY TO LETTERING ON FIGURES

The lettering of all figures is uniform and is as follows :

A	Dorsal and ventral aspects of body	L	Hind claw, posterior view
A1	Lateral aspect of body	M	Part of inner margin of fore coxa, showing setae and coxal bristle(s)
B	Head, dorsal view		
C	Head, ventral view	N	Articulation of fore wing, showing pteralia
D	Mesoprephragma, anterior view		
E	Mesopostphragma, posterior view	O	3rd axillary wing sclerite, posterior view
F	3rd segment of left antenna, ventral view	P	Subalare, dorsal view
G	10th segment of left antenna, ventral view	Q	Caudal extension of 8th abdominal segment, dorsal view
H	Membranous area of scutum	R	Apex of penial sheath, ventral view
I	3rd axillary wing sclerite, dorsal view	S	Apex of penial sheath, ventral view
J	Fore claw, posterior view		
K	Middle claw, posterior view	T	Tentorium and cranial apophysis

ABBREVIATIONS USED IN THE FIGURES

aas	ante-anal setae	als	alar seta
ab	antennal bristles	ams	antemetaspiracular setae
ads	abdominal dorsal setae	amss	anterior metasternal setae
aed	aedeagus	an	anus
al	alar lobe	anp	anterior notal wing process

apar	anterior postalar ridge
as	abdominal sternite
asc	additional sclerite
ase	apical seta
$astn_1s$	anteprosternal seta
at	abdominal tergite
ata	anterior tentorial arm
atp	anterior tentorial pit
avs	abdominal ventral setae
ax_1	first axillary wing sclerite
ax_2	second axillary wing sclerite
ax_3	third axillary wing sclerite
bas	basalare
bma	basal membranous area
bra	basal rod of aedeagus
bs	sensilla basiconica
c	cicatrix
ca	cranial apophysis
cb	coxal bristle(s)
ccx	costal complex of wing veins
ce	caudal extension
cl	claw
cx	coxa
dhs	dorsal head setae
dmcr	dorsomedial part of midcranial ridge
dos	dorsal ocular setae
dps	dorsopleural setae
dse	dorsal simple eye
dss	dorsospiracular setae
epm_2	mesepimeron
epm_3	metepimeron
eps_2	mesepisternum
eps_3	metepisternum
eps_3s	postmetaspiracular setae
f	furca
F_{iii-x}	segments of flagellum, 3rd to 10th
fm	femur
fp	furcal pit
fs	fleshy seta
g	gena
gls	seta of glandular pouch
gp	glandular pouch
gs	genal setae
gts	setae of genital segment
h	haltere
hs	hair-like seta
ior	interocular ridge
lmcr	lateral branch of midcranial ridge
lpl	lateropleurite
lse	lateral simple eye
mc	median crest
mdr	median ridge
med	media
mo	mouth opening
mpns	medial pronotal setae
mr	marginal ridge
mts	metatergal setae
o	ocellus
ocs	ocular sclerite
pa	postalare
pcr_2	precoxal ridge of mesothorax
pcr_3	vestigial precoxal ridge of metathorax
pdc	pedicel
pepcv	proepisternum + cervical sclerite
pla_1	propleural apophysis
pla_2	mesopleural apophysis
pla_3	vestigial metapleural apophysis
plr_1	propleural ridge
plr_2	mesopleural ridge
plr_3	metapleural ridge
pms	postmesospiracular setae
pmss	posterior metasternal setae
pn_2	mesopostnotum
pn_3	metapostnotum
pna	postnotal apophysis
pnp	posterior notal wing process
pnr	pronotal ridge
pocr	postocular ridge
ppar	posterior postalar ridge
pra	prealare
prn	lateral pronotal sclerite
prnr	pronotal ridge
procr	preocular ridge
pror	preoral ridge
prsc	prescutum
ps	penial sheath
pscr	prescutal ridge
pscs	prescutal suture
pt	post-tergite
pta	posterior tentorial arm
ptp	posterior tentorial pit
ptr_2	peritreme of mesothoracic spiracle
ptr_3	peritreme of metathoracic spiracle
pts	post-tergital setae
pwp_2	mesopleural wing process
pwp_3	vestigial metapleural wing process
rad	radius
sa	subalare

set. scla	subapical seta	t	tendon-like apodeme
scl	scutellum	tar	tarsus
sclf	scutellar foramen	tb	tentorial bridge
scls	scutellar setae	tdgt	tarsal digitule
scp	scape	teg	tegula
sct	scutum	tegs	tegular setae
sctse	scutal setae	tib	tibia
ser	subepisternal ridge	tibs	tibial spur
sp_2	mesothoracic spiracle	tp	triangular plate
sp_3	metathoracic spiracle	tr	trochanter
spl	sensillum placodeum	udgt	ungual digitule
ss	suspensorial sclerite	vhs	ventral head setae
stn_1	prosternum	vmcr	ventral part of midcranial ridge
stn_2	basisternum of mesosternum	vps	ventropleural setae
stn_3	metasternum	vs	ventral sclerite
stn_1s	prosternal setae	vse	ventral simple eye
stn_2s	basiternal setae		

GENERAL MORPHOLOGY

The first serious attempt to study the morphology of the male of the Coccidae was made by Putnam (1879) in his paper on *Pulvinaria innumerabilis*. Apart from morphological observations, he suggested that the shape and proportions of the scutellum (which he called apodema) would be of some value in distinguishing the species of *Pulvinaria*. After Putnam's work, attention was shifted almost completely to the female, but some authors, e.g. Moulton (1907), Silvestri (1919a, 1919b, 1920), Cusciana (1931), Hadzibejli (1955), Kawecki (1958b) and Husseiny & Madsen (1962) included brief descriptions of the male when describing the females of single species. Newstead (1903), Green (1904–1909), Leonardi (1920), Šulc (1932) and Borchsenius (1957) each dealt with a series of females from definite localities ; they included short descriptions of the males available and usually gave a general account of the male of the family. Of all these, the works of Šulc and Borchsenius are the most significant. Šulc's interpretation of the thoracic structures is fairly accurate, and he pays special attention to the eyes, halteres and chaetotaxy of the head in differentiating the species studied. Borchsenius' paper contains a number of inaccuracies concerning the homologies of the various structures, but he describes and illustrates the differences in the head, 3rd and 10th antennal segments, scutellum and terminal abdominal segments (including the genital segment) in the species that he studied. A small number of workers, namely Pesson (1941), Dürr (1954), Habib (1956) and Bustshik & Saakjan-Baranova (1962) devoted papers to the description of the males of individual species, but their descriptions are rather superficial and contain many inaccuracies. Jancke (1955), Ezzat (1956) and Theron (1958) made comparative studies of the males of a number of families ; each of them included one member of the Coccidae : *Physokermes piceae*, *Pulvinaria ericicola* and *Parthenolecanium pomeranicum* (described as *Eulecanium taxi*) respectively. While Ezzat and Jancke contributed little that is morphologically significant, Theron gave a very detailed and accurate account, and was the first to make a comprehensive study of the pleural region.

In the present investigation it was possible, by studying a more representative sample (23 species), to substantiate Theron's findings, to record a number of characters which have hitherto been unknown or overlooked, and to gain information on the range of variation within the family. In the general description of the morphology of male Coccidae that follows, Theron's terminology is followed except where otherwise stated ; the account is illustrated by a generalized figure (Text-fig. 1) and all abbreviations in brackets refer to this figure, unless otherwise indicated.

General Characteristics

Compared with other Coccoidea, the males of the Coccidae are medium-sized, being smaller than the Margarodidae and larger than the Diaspididae. Among the species studied the smallest was *L. luzulae* (1020–1290, average 1141 μ long) and the largest *E. pela* (2500–3100, average 2864 μ long) ; *L. luzulae* had the shortest wing-span (2090–2350, average 2213 μ) and *E. pela* the longest (5330–5700, average 5563 μ). Some species are slender in appearance (e.g. *C. hesperidum*) while others are rather robust (e.g. *Ceroplastes* spp.).

The body colour of living specimens varies from light reddish brown (*E. festucae*) to purplish (*P. bituberculatum*) ; the sclerotized areas are darker, brown to black, and the legs and the antennae yellowish ; the wings are hyaline, often with a purplish tinge between anterior margin and first wing vein.

In some species (e.g. the *COCCUS* group, Text-figs. 31–43) the head carries numerous setae, which give it a " hairy " appearance ; when the setae are few in number (the *EULECANIUM* group, Text-figs. 2–23) the head looks rather bare.

The body is divided into the head, thorax and abdomen ; the head is separated from the thorax by a distinctly constricted " neck ", characteristic of the Coccidae and Pseudococcidae.

The *head* (Text-fig. 1B, C) is irregular in shape, generally wide near the base dorsally, and narrowed anteriorly and ventrally. In dorsal view it is somewhat cone-shaped, broad and rounded posteriorly, with a tapering, more or less protruding apex. In lateral view the anteroventral surface slopes backwards towards the conspicuous, conical, medioventral bulge, which carries a pair of ventral eyes. The head is comparatively well sclerotized, with fewer and less developed secondary ridges than in the Diaspididae (see Ghauri, 1962) ; it carries 2–5 pairs of simple eyes and a pair of lateral ocelli. Mouth parts are absent, but an oval, non-functional mouth opening is present behind the medioventral bulge. The antennae are long, filiform and ten-segmented.

Thorax. The prothorax is considerably desclerotized, with a few more or less developed ridges and small sclerites. The mesothorax is well developed, sclerotized and with strong supporting ridges ; prescutum, scutum, scutellum and postnotum are all distinct, the latter curving down into the metathoracic cavity ; pleural sclerites are well developed, the pleural ridge strong ; basisternum large and usually with a median ridge. The fore wings are well developed, with two veins. The hind pair is reduced to halteres or absent ; when present each haltere has 1–4, apically hooked setae. The legs are long and slender with a one-segmented tarsus and a single claw. The meso- and metathorax each carry a spiracle laterally.

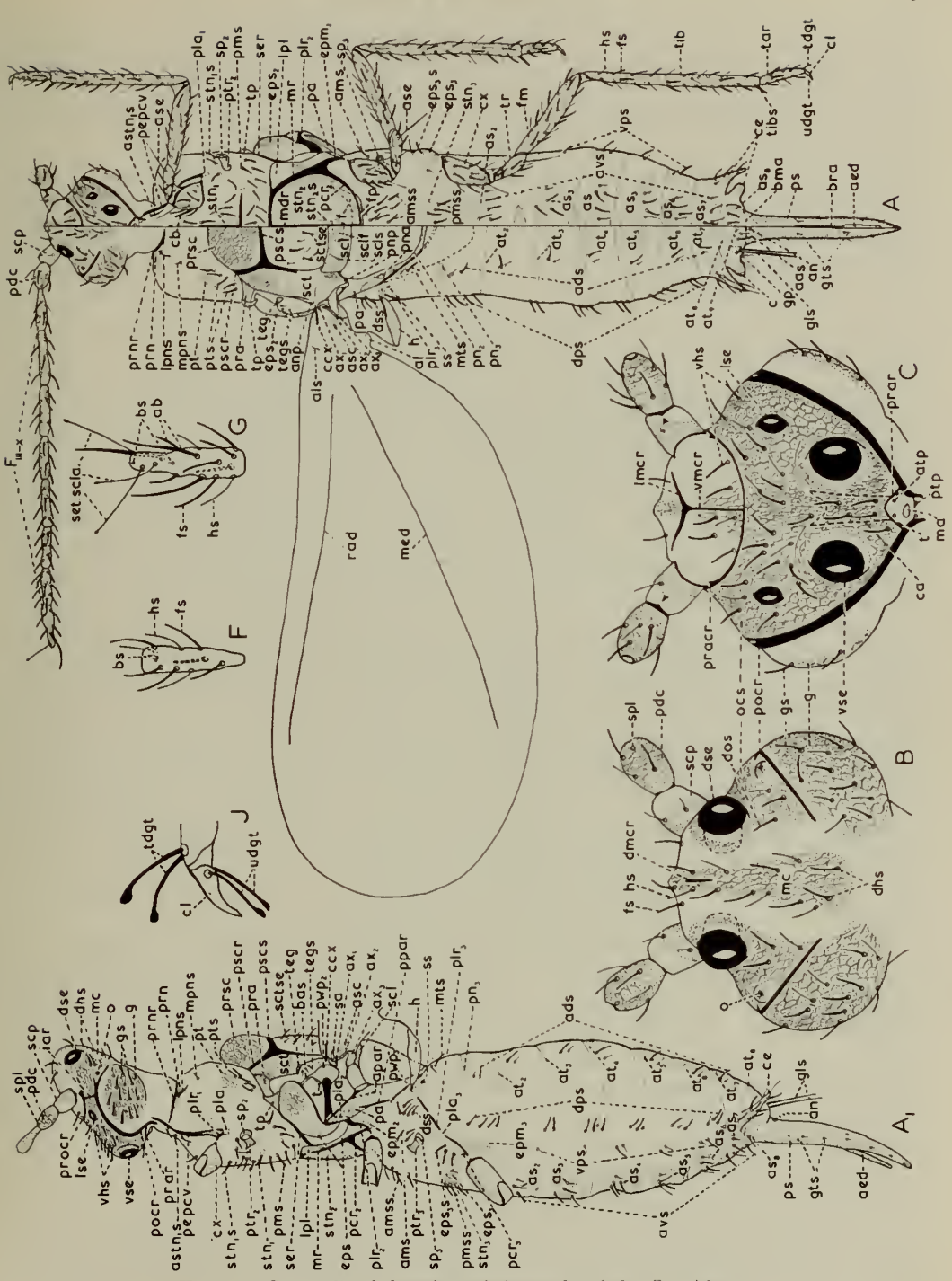


FIG. 1. Generalized drawing of the male of the Coccidae.

The *abdomen* is parallel-sided, with a slightly tapering posterior end. It consists of 8 pregenital segments and the genital segment ; the latter is narrow, elongated, partly sclerotized, and carries the genital organs. The pregenital segments are usually almost entirely membranous (e.g. *P. pomeranicum*), but sometimes with a small tergite and sternite on each segment (e.g. *E. tiliae*). Sometimes (the *COCCUS* group) segments VII and VIII are each produced laterally into a finger- or lobe-like caudal extension ; posteriorly segment VIII usually carries a subdorsal glandular pouch, from the bottom of which two long setae arise ; they serve as a supporting core for a long wax filament.

The Head

Head Capsule

Theron (1958) showed that, of the three regions of the generalized homopteran head (Weber, 1928 ; 1935), only one of them, i.e. the epicranium, makes up almost the entire head capsule in the Coccoidea ; of the other two regions the so-called " Vorderkopf " is reduced to a small area around the non-functional mouth opening, while the third, the labium, is absent altogether. Compared with other families, the head of the Coccidae is peculiar in having the anterodorsal part of the head capsule considerably expanded, with the apex sometimes produced into an anterodorsal bulge. Apparently the enlarged dorsal part has shifted forwards and the ventral part backwards ; this process of transformation appears to resemble rotation about a point near the lateral ocellus. As a result some structures, which in the other Coccoidea are situated on the dorsal surface of the head, have been translocated forwards or even to the ventral side. Thus the antennae occupy a ventral position, the median crest extends anteriorly over the apex of the head and terminates between the antennae, and the ventral part of the midcranial ridge does not reach the apex of the head. At the same time the dorsal membranous area of the posterior part of the head and neck has become extended. The degree of this deformation of the head varies within the family from a condition that is comparatively normal and similar to the Pseudococcidae (e.g. *E. tiliae*, Text-fig. 3) to the extreme as shown by *C. hesperidum* (Text-fig. 32).

The dorsomedial part of the epicranium, which corresponds to the *median crest* (mc) of the Diaspididae (see Theron, 1958 ; Ghauri, 1962), is slightly raised, weakly sclerotized, and usually polygonally reticulated, but in a few cases (*F. viburni*, *Ctenochiton* sp. ; Text-figs. 14, 16 ; B) with only weak striations. The posterior margin is usually broadly rounded, but sometimes obtuse (*I. theobromae*, Text-fig. 29, B), and somewhat more heavily sclerotized, although no distinct ridge is present as found by Theron (1958) and Giliomee (1961) in the Pseudococcidae. The heavier sclerotization probably serves to strengthen the epicranium in a region where, according to Theron (1958), the mesothoracic muscles are attached. Borchsenius (1957) referred to the median crest as the " cephalic longitudinal plate ".

In the anterior part of the median crest there is sometimes a linear vestigial ridge (dmcr), which corresponds to a similar structure found in *Planococcus citri* (Theron, 1958) and interpreted by Theron as a detached dorsal part of the *midcranial ridge*.

It is best developed in *N. abietis* (Text-fig. 4, B), where it stretches anteriorly from behind the level of the posterior margin of the eyes to the anterior margin of the head, but even in this case it is not joined to the ventral part of the midcranial ridge (vmcr). The latter is usually well developed and Y-shaped. The median part of the ridge merges posteriorly into the ocular sclerite, but in some cases (*I. theobromae*, Text-fig. 29, C; the *ERIOPELTIS* group, Text-figs. 24, 26, 27, C) it fades away before doing so and in *Ceroplastodes chiton* Green it is vestigial. The *lateral arms* (lmcr) run to the base of each scape, but do not articulate with it. The arms are long in some species (*I. theobromae*, Text-fig. 29, C), short in others (*Eriopeltis* sp., Text-fig. 24, C), or even absent (*E. ?festucae*, Text-fig. 26, C). The area around the posterior section of the median part of the midcranial ridge is usually membranous and weakly polygonally reticulated. Rarely, however, the reticulation is entirely absent (*Ctenochiton* sp., Text-fig. 16, C ; Genus *A*, Text-fig. 20, C) or the area is both reticulated and sclerotized (*Eriopeltis* spp., *P. myrtilli*, *I. theobromae* ; Text-figs. 24 & 26, 14, 12, 29 ; C). This area corresponds to the ventromedial part of the epicranium of the more primitive margaroid Coccoidea, where it is sclerotized. The ventral part of the midcranial ridge was described as the " chitinous impression " by Pesson (1941), the " mesantennal plate " by Borchsenius (1957) and the " sclerotized fork " by Bustshik & Saakjan-Baranova (1962). The Russian workers suggested, quite erroneously, that it might represent a rudiment of the mouth apparatus.

The large *ocular sclerite* (ocs), dorsally separated from the median crest by a membranous band surrounding the latter, constitutes most of the ventral and part of the lateral surface of the head capsule ; ventrally it extends uninterrupted from one side of the head to the other. It is distinctly polygonally reticulated. The ocular sclerite is partly bounded anteriorly by the *preocular ridge* (procr), which provides a process for articulation with the scape. In some species (the *ERIOPELTIS* group, *Ctenochiton* sp., *E. pela*, Genus *A* ; Text-figs. 24, 26, 27 and 16, 18, 20 ; C) it is fused with, or closely approximates its opposite number, where it may also be joined by the median bar of the midcranial ridge. More often, however, it fades away at some distance from the articulating process.

The posterior margin of the ocular sclerite is bounded for the most part by the well developed *postocular ridge* (pocr). Dorsally the ridge originates behind the dorsal eye at about the level of the posterior margin of the median crest, passes behind the ocellus and extends posteromedially across the lateroventral surface of the head. Near the median line it curves backwards and extends for a short distance beyond the anterior end of the proepisternum + cervical sclerite, either as a definite ridge or as a small sclerite. In most species the ridge forks below the ocellus, with the short anterior branch surrounding or partly surrounding the ocellus. In the *COCCUS* group the postocular ridge is strong and thick throughout, but in the other groups the dorsal part of it is weaker, uniformly thin or gradually narrowing ; occasionally the part of the ridge immediately behind the ocellus is missing or very weak (*R. spiraeae*, Genus *A* ; Text-figs. 9, 21). In the literature the ridge has been illustrated, but not discussed by Leonardi (1920),

Silvestri (1919a, 1919b, 1920), Šulc (1932) and Jancke (1955) ; it has been called the chitinous apodeme (Pesson, 1941) and lateral arches (Borchsenius, 1957 ; Bustshik & Saakjan-Baranova, 1962).

Sometimes the pre- and postocular ridges are joined together below the ocellus by a strong ridge ; this ridge has not been observed before and is here called the *interocular ridge* (ior). Its presence is constant in a few species (the *ERIOPELTIS* group ; Text-figs. 25, 28), where it is a broad ridge ; in one other species (Genus *A* ; Text-figs. 20, C ; 21) its occurrence is irregular : it is very narrow if present, sometimes present on one side only and occasionally absent on both sides. On the preocular ridge in *I. theobromae* (Text-fig. 30) a small posteriorly directed process below the articular process apparently represents a rudiment of this ridge. The homology of the interocular ridge and its possible relation to the conditions found in the Pseudococcidae will be discussed later.

The ocular sclerite bears a number of simple eyes and a pair of lateral ocelli. The simple eyes comprise a pair of dorsal and a pair of ventral eyes, while 1–3 pairs of additional lateral ones may be present.

The *dorsal eyes* (dse) are situated on the anterolateral part of the head above the bases of the antennae and are widely separated from each other. The *ventral eyes* (vse) are located on the medioventral bulge close to each other in a submedian position ; the area between the ventral eyes is somewhat raised (e.g. *E. tiliae*, Text-fig. 3) or flat (e.g. *L. luzulae*, Text-fig. 28). The *lateral eyes* (lse) occur on each side of the head, more or less in line with the dorsal and ventral eyes. The dorsal and ventral eyes are usually large and subequal in size, while the lateral ones are considerably smaller. Sometimes (*I. theobromae*, Text-fig. 29, 30 ; *Ceroplastodes chiton* Green) the lateral eyes are only slightly smaller or as large as the others. The corneae of all these simple eyes are circular, deeply produced into the head-capsule and surrounded by a narrow membranous ring. The dorsal and ventral eyes are always present and are the only ones which occur in the *ERIOPELTIS* and *COCCUS* groups and some species of the *EULECANIUM* group (Text-figs. 24–43, 6, 10, 22) ; some other species have one (*N. abietis*, Text-fig. 4), two (*R. spiraeae*, *P. myrtilli*, *Ctenochiton* sp., Genus *A*, *I. theobromae* ; Text-figs. 8, 12, 16, 20, 29) or three (*E. tiliae*, *F. viburni*, *E. pela* ; Text-figs. 2, 14, 18) additional lateral eyes. The *lateral ocellus* (o) usually appears as a weakly sclerotized spot on a membranous bulge, which is somewhat conical in *Eriopeltis* spp. (Text-figs. 24, 26). It is situated posterolateral to the dorsal simple eye, immediately anterior to the postocular ridge. The structure of the eyes and their innervation in *P. corni* were studied by Pflugfelder (1936). From his work it seems certain that the simple eyes on one side represent the isolated facets of a single compound eye. He also claimed that the lateral ocelli are persisting larval ocelli, a view already held by Putnam (1879) and Moulton (1907).

The large lateral bulge posterior to the postocular ridge corresponds to the *gena* (g). It is weakly sclerotized and in most species it is distinctly reticulated (e.g. *Eriopeltis* spp., *Parthenolecanium* spp. ; Text-figs. 24 & 26, 38 & 39). The sclerotization and

reticulation were not described by Theron (1958). The deep cervical groove immediately behind the genae indicates the posterior margin of the head.

Ventromedially, immediately behind the ocular sclerite, the *preoral ridge* (pror) is situated. It has the form of an inverted V and is very narrow. It fuses posteriorly with the postocular ridge. Sometimes it is completely absent (the *ERIOPELTIS* group, Genus *A* ; Text-figs. 24, 26, 27 and 20 ; C).

The preoral ridge gives support to the *cranial apophysis* (ca), which is a strong scoop-like structure (Text-figs. 24, 39 ; T). Its apex is usually bifurcate, but sometimes trifurcate (*Eriopeltis* sp., Text-fig. 24, C) or truncate (*E. pela*, *E. ?festucae*, *L. luzulae* ; Text-figs. 18, 26, 27 ; C). In some cases the apex also carries an irregular central lobe, which is very pronounced in Genus *A* (Text-fig. 20, C). Theron (1958) found that in *P. pomeranicum* eight antennal muscles are attached to the apex of the cranial apophysis. The length of the cranial apophysis varies within the family. It is long in some species (e.g. *C. hesperidum*, Genus *B* ; Text-figs. 31, 33 ; C), reaching the level of the anterior margin of the ventral eyes, while in others (e.g. *E. tiliae*, *P. piceae* and *E. pela* ; Text-figs. 2, 6, 18) it does not extend beyond the posterior level of these eyes.

An irregular *mouth opening* (mo) is situated on a slight membranous bulge behind the cranial apophysis. On each side of the mouth opening, immediately median to the junction of the preoral and postocular ridges, a *tendon-like apodeme* (t) is present. According to Theron (1958) it serves for the attachment of a muscle which extends to the posterior margin of the median crest. In *R. spiraeae* this apodeme has a broad base and in Genus *A* it arises from the anterior part of an elongated sclerite (Text-fig. 20, vs) which appears to represent the *ventral sclerite* described by Theron (1958) in the margaroid *Pseudaspidoproctus ?fulleri*. The ventral sclerites were regarded by Theron as vestiges of the ventral plate found in *Margarodes*. They are also present in some Diaspididae (Ghauri, 1962).

The *tentorial pits* are situated in the membrane around the mouth opening. In a few species (e.g. the *ERIOPELTIS* group ; Text-figs. 24, 26, 27 ; C) four tentorial pits are present. The two *anterior* ones (atp) are situated anterolateral to the mouth opening, near the preoral ridge when the latter is present ; these pits are, however, usually absent. The *posterior* tentorial pits (ptp) are found posterolateral to the mouth opening, immediately median to the posterior ends of the postocular ridges ; they are always present. From each posterior pit a thread-like *posterior tentorial arm* (Text-figs. 24, 39 ; T ; pta) extends towards the heavily sclerotized *tentorial bridge* (Text-figs. 24, 29, T ; tb). From the bridge the somewhat stouter *anterior tentorial arms* (Text-figs. 24, 39 ; T ; ata) extend towards the cranial apophysis. It is difficult to make out exactly how these arms are associated with the cranial apophysis. When the anterior tentorial pits are present, a thread-like anterior extension from each tentorial arm, possibly representing the dorsal tentorial arm links the anterior arms with the edges of the cranial apophysis (Text-fig. 24, T). When the anterior pits are absent, the arms are intimately associated with the cranial apophysis, as shown in Text-fig. 39, T. The latter condition appears to be the result of a process in which the anterior pits have drifted forwards until they

reached the cranial apophysis and apparently the anterior arms have completely fused with the " dorsal " ones. No sclerotized ventral cavity as illustrated by Theron (1958, fig. 22) is apparent and the illustration does not seem to agree with his description and fig. 13, where the ventral cavity is shown to be situated behind the preoral ridge. The tentorium has not been described by other workers, but from an examination of specimens in which the head is distorted, it is clear that what Borchsenius (1957) called the " cephalic sclerotized arch " and Bustshik & Saakjan-Baranova (1962) regarded as the occipital ridge, is in fact the tentorial bridge.

Chaetotaxy

Two distinct types of setae, similar to those found in *Pseudococcus* (Giliomee, 1961), are present on the head of male Coccidae. They are:

(i) a thick-set, *fleshy* type (fs), which has a rather blunt apex and the setal membrane not surrounded by a distinct basal ring, and

(ii) a slender, *hair-like* type (hs) which has an acute apex and the setal membrane surrounded by a strong basal ring.

Generally the hair-like setae occur in all the species in comparatively small numbers and when only these setae are present the head appears to be rather bare. In those species where fleshy setae are also present the head has a " hairy " appearance, the number of these additional setae being generally much larger.

The setae on the head are arranged in the following groups:

(i) *Dorsal head setae* (dhs), which are situated on the median crest, but may also occur on the surrounding membrane in front of the dorsal simple eyes. This group consists either of hair-like setae only (the *EULECANIUM* and *ERIOPELTIS* groups) or of both fleshy and hair-like ones (the *INGLISIA* and *COCCUS* groups). The number of hair-like setae, which are present in all the species, varies from 1–7 (average 5) in *P. acericola* to 16–19 (average 17) in *P. corni* ; the number of the additional fleshy setae, in the species in which they occur, varies from 4–11 (average 7) in *I. theobromae* to 26–42 (average 35) in *C. hesperidum.*

(ii) *Dorsal ocular setae* (dos), which are found on each side on the dorsal part of the ocular sclerite between the dorsal simple eye and the postocular ridge, and consist of both fleshy and hair-like setae. The total numbers of these setae are small and variable and the proportion of the two types of setae is also variable within the species.

(iii) *Ventral head setae* (vhs) : This group occurs on the ventral and lateral parts of the ocular sclerite and may extend up to the lateral arms of the midcranial ridge. In the *COCCUS* and *INGLISIA* groups, but not in the other species examined, the setae also occur between and behind the ventral eyes. In most species of the *EULECANIUM* group the setae are situated only on or anterior to the level of the preocular ridge. In a few species (Genus *A*, *S. prunastri*, *L. luzulae*; Text-figs. 20, 22, 27 ; C) one pair of median hair-like setae is distinctly longer than the other setae. The hair-like setae occur in all the species in small numbers, varying from 1–2 (average 1·3) in *N. abietis* to 7–17 (average 12) in *E.? festucae*, but in *R. spiraeae*

they may be entirely absent in some individuals. The additional fleshy setae occur only in the *ERIOPELTIS, COCCUS* and *INGLISIA* groups (Text-figs. 24–43) and here in rather large numbers, varying from 9–16 (average 12) in *Eriopeltis* sp. to 54–108 (average 84) in *Pulvinaria ?ribesiae.*

(iv) *Genal setae* (gs), which are found on the genae and are only present in the *COCCUS* and *INGLISIA* groups (Text-figs. 29–43). They consist of both fleshy and hair-like setae. The number of hair-like setae is usually small, varying from 0–4 (average 1·2) in *I. theobromae* to 7–13 (average 9) in *P. corni*, and the number of fleshy setae large, varying from 5–11 (average 7) in *I. theobromae* to 17–30 (average 23) in *P. corni.*

No other dermal structures, like disc pores or specialized sensilla are present on the head.

Antennae

All the workers that have studied the head of male Coccidae mention the antennae, but their descriptions are very brief and usually cover little more than the number of segments and the general shape of the antennae.

The antennae are inserted fairly low down on the anterolateral margin of the head with the diverging lateral arms of the midcranial ridge between them. They are generally filiform in shape and normally comprise ten segments, but sometimes two or more of the segments between the 4th and 9th are intimately fused. The relative length of the antennae varies considerably within the family. They are very long in the *ERIOPELTIS* group, being about $\frac{2}{3}$–$\frac{5}{6}$ as long as the body in *Eriopeltis* sp., and short in the *COCCUS* group, being usually less than half as long as the body. The antennae with the shortest relative length are found in *E. tiliae* (*EULECANIUM* group) where they are $\frac{1}{3}$–$\frac{2}{5}$ as long as the body. The average absolute length varies from 622 μ in *C. berliniae* to 1922 μ in *E. pela.*

The antennae always carry a large number of setae, which give them a " hairy " appearance. The setae consist of both fleshy and hair-like ones, similar to those occurring on the head. The *fleshy setae* (fs) appear usually only on the 2nd to 10th segments, but in *E. pela* they occur regularly on the 1st segment as well. They are usually slightly longer than the width of the antennal segments, although a few on the distal part of the 4th to 9th segments may be considerably shorter. In *E. pela*, however, the fleshy setae are exceptionally long, being about 4–5 times as long as the width of the 3rd segment, and in Genus *A* they are very short and stout, and only about half as long as the width of the 3rd segment. The *hair-like setae* (hs) are always present on the first two segments and in a number of species (e.g. *E. tiliae, F. viburni*, Genus *A*, Text-figs. 2, 14, 20 ; F) also on the 3rd, but only in *F. viburni* and Genus *A* do they occur regularly on the 4th to 10th segments. In addition to the fleshy and hair-like setae two different types of setae are found on the distal segments. The setae of one of them somewhat resemble the ordinary fleshy setae, but are usually much larger, bristle-like and have a large setal membrane ; they can be called *antennal bristles* (ab). On the 10th segment there also occur the long,

capitate, *subapical setae* (set. scla) found in the Pseudococcidae (Šulc 1943 ; Giliomee, 1961) and Diaspididae (Bustshik, 1958 ; Ghauri, 1962). Šulc called them setae semi-claviformes. Both types probably have a sensory function. Specialized sensilla are present on the 2nd, 3rd and 10th segments.

The *scape* (scp) is short, wide and subrectangular in shape, with the basal part sclerotized and the distal part mostly membranous. The dorsal margin is longer than the ventral one. The scape articulates with the pedicel by means of a ventral projection, which is situated opposite a corresponding projection on the basal ridge of the pedicel. Posterolaterally it articulates with the preocular ridge by means of a process on its basal ridge. The scape usually carries 3 hair-like setae and in *E. pela* 2–4 (average 2·6) fleshy setae also occur on this segment.

The *pedicel* (pdc) is short, broad and subglobular in shape. It is generally well sclerotized with the distal part, especially dorsally, distinctly polygonally reticulated. In *P. myrtilli* (Text-fig. 12, B), the reticulation is represented by a few wavy lines and in *P. ?betulae* (Text-fig. 35, B) and *I. theobromae* (Text-fig. 29, B) the reticulation is usually entirely absent. The base of the pedicel is partly surrounded by a strong basal ridge which is well developed ventrally, but weaker or absent dorsally. At the dorsal end there is a shallow depression in which the constricted basal part of the 3rd segment is received. Both hair-like and fleshy setae are present ; they are mostly located on the ventral and lateral surfaces. A small circular sensillum, probably a sensillum placodeum, is situated dorsally or dorsolaterally. It is also present in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

The *flagellum* (F_{iii-x}) is composed of the 3rd to 10th segments. The *3rd segment* (Text-figs., F) varies considerably in size and shape ; in *Eriopeltis* spp. (Text-figs. 24, 26 ; F) it is long and club-shaped, while it is short and barrel-shaped in *P. ?betulae* (Text-fig. 35, F). This segment carries ventrally a number of small *sensilla* (bs), which are probably sensilla basiconica. Their number varies individually and may do so on the two antennae of the same specimen, but it rarely exceeds a total of four. Sensilla were also found in the same area in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962). The 8th and 9th segment each has an antennal bristle, which is sometimes difficult to distinguish from the fleshy setae ; the bristle is situated ventrally near the apex.

In most species the *10th* (terminal) *segment* is broadly rounded at its apex, but in some (e.g. *C. hesperidum* ; Text-fig. 31, G) the distal part of the segment is tubularly constricted. In addition to the fleshy and occasional hair-like setae this segment also bears a number of *antennal bristles* (ab) and capitate *subapical setae* (set. scla). The former consist of 3 long and 2 shorter setae. The subapical setae are usually 3 in number, but in *I. theobromae* there are only 2 and in Genus *A* there are 4–6 (average 5). On the ventral surface of the 10th segment 2 small *sensilla* (bs) are found, one near the apex and the other somewhat more proximal. They are probably sensilla basiconica and correspond to sensilla on this segment in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

The Thorax

Prothorax

The prothorax is largely membranous, with only a few sclerites and ridge-like structures present. It is distinctly separated from the head by a deep cervical constriction. In this respect the Coccidae resemble the Pseudococcidae (Theron, 1958 ; Giliomee, 1961).

Dorsally, immediately behind the neck region, the collar-like *pronotal ridge* (prnr) runs continuously from one side to the other, extending ventrally and closely approximating the proepisternum + cervical sclerite. It is usually interrupted by weak sclerotization dorsomedially, but in *E. pela* the ridge is apparently uninterrupted, although very narrow medially. This structure has been called the " protergal sclerite " (Habib, 1956), the " prothoracic suture " (Ezzat, 1956) and the " prothoracic arch " (Borchsenius, 1957). Dorsolaterally, behind the pronotal ridge, a small sclerite is closely associated with it ; this sclerite appears to be homologous with the *lateral pronotal sclerite* (prn) described by Giliomee (1961) in the Pseudococcidae and Ghauri (1962) in the Diaspididae. The sclerite was called the " prothoracic sclerotized plate " by Borchsenius (1957). Theron (1958) did not mention them.

In the posterolateral part of the prothorax a small sclerite is situated ; it constitutes the so-called *post-tergite* (pt). It sometimes shows irregular wavy striations (e.g. most species of the *COCCUS* group). In *Eriopeltis* sp. the sclerite is apparently absent and only represented by striations of the derm. The post-tergites have not been observed in this family before.

In the pleural region the pleurites and neck sclerites are reduced to a single ridge-like structure, called the *proepisternum + cervical sclerite* (pepcv) (Ghauri, 1962). Anteriorly it passes just below the ventral end of the pronotal ridge and appears to be joined by weak sclerotization to the postocular ridge. For a short distance behind the level of the pronotal ridge this sclerite is less strongly sclerotized. This phenomenon was also observed in *Pseudococcus* (Giliomee, 1961). Posteriorly the sclerite is delimited by a short *pleural ridge* (plr_1), which articulates ventrally with the basal process of the coxa ; dorsally it is invaginated to form a small *pleural apophysis* (pla_1). Crampton (1926) called the structure a " neck plate " or " laterocervicale " in *Coccus*. He also distinguished an episternum and epimeron, but no structure corresponding to the latter was observed in the species studied here. From his illustration (fig. 55) it appears that he misinterpreted the position of the pleural ridge. The proepisternum + cervical sclerite has also been referred to as the " pleural sclerite of the prothorax " (Ezzat, 1956), the " propleural sclerite " (Habib, 1956) and the " sclerotized plate of the anterior leg " (Borchsenius, 1957).

The *prosternum* (stn_1) is represented by a single sclerite, of which the degree of development shows considerable interspecific and also some intraspecific variation. In its most complete form it consists of a triangular, sometimes oval sclerite, which is bounded posteriorly by a strong transverse ridge and traversed by a longitudinal median ridge. Sometimes the prosternal sclerite is more or less reduced (*C. hesperidum*, Text-fig. 31), while the median ridge may be complete (e.g. *P. myrtilli*,

C. hesperidum ; Text-figs. 12, 31), interrupted in the middle (e.g. *E. tiliae*, *E. festucae*, *P. corni* ; Text-figs. 2, 26, 38), developed anteriorly only (e.g. *Eriopeltis* sp., *P. pomeranicum* ; Text-figs. 24, 39), or represented by a basal stalk (*R. spiraeae*, *L. luzulae* ; Text-figs. 8, 27). In some species the degree of reduction of the median ridge varies individually, e.g. in *F. viburni* and *P. betulae* the ridge may be complete or developed anteriorly only, while in *P. bituberculatum* and *S. prunastri* it may be absent or represented by a short basal stalk only. On each side of the transverse ridge a shallow depression probably represents the sternal apophysis. Its position corresponds to that of the sternal apophyses in the more primitive Phenacoleachiidae (Theron, 1962). In some individuals of most species a small apopysis is situated medially anterior to the prosternum. It probably serves for the attachment of muscles, as four muscles originate in the corresponding area in the Pseudococcidae (Mäkel, 1942). Theron (1962) describes a " mammillate organ " from the same region in the Phenacoleachiidae, saying that it is probably homologous with the so-called salivary gland of *Pseudaspidoproctus*. The derm of the prosternum is occasionally polygonally reticulated (*C. hesperidum*, Text-fig. 31) or covered with numerous small spines (*I. theobromae*, Text-fig. 29). The prosternum was overlooked by most earlier workers. Crampton (1926) figures a linear basisternum and sternellum, while Ezzat (1956) called this region a basisternum ; Borchsenius (1957) regarded it as part of the mesosternum.

Dermal Structures. Both fleshy and hair-like setae are present in various regions of the prothorax. They occur in the following groups :

(i) *Lateral pronotal setae* (lpns), which occur on or immediately posterior to the lateral pronotal sclerites on each side, and may consist of up to 3 fleshy or hair-like setae. They are of very little taxonomic significance as they are only present in some individuals of certain species (e.g. *P. pomeranicum*, Text-fig. 39).

(ii) *Medial pronotal setae* (mpns), which are situated between the pronotal ridge and the post-tergites and usually consist of two widely separated hair-like setae (e.g. *P. myrtilli*, *S. prunastri*, *C. hesperidum*, Text-figs. 12, 22, 31) ; in *P. bituberculatum* (Text-fig. 10) the two setae are situated close together on the median line. In other species (e.g. *N. abietis*, *I. theobromae*) one or both setae may be absent, while medial pronotal setae are absent altogether in some species (e.g. *E. tiliae*, *L. luzulae*). One or two fleshy setae are occasionally associated with these setae. Medial pronotal setae are also found in the Pseudococcidae (Giliomee, 1961).

(iii) *Post-tergital setae* (pts) occurring on, or behind and below the post-tergites. They consist of fleshy setae only (up to 13) and were found in the closely related genera *Pulvinaria*, *Coccus* and Genus *B* (Text-figs. 31, 33, 35, 37), but not in the other species.

(iv) *Anteprosternal setae* ($astn_1s$) consisting of a number of fleshy setae (up to 7) which occur immediately ventral to the anterior part of the prosternum + cervical sclerite (pepcv). They are present in the *COCCUS* group (Text-figs. 31–43) and sometimes in *L. luzulae*.

(v) *Prosternal setae* (stn_1s), which are found on and around the prosternum, anterior to the level of the transverse ridge ; in the *COCCUS* group they extend

laterally to occur anterior to the mesothoracic spiracle. This group therefore corresponds to the prosternal and antespiracular ventral setae of the Pseudococcidae (see Giliomee, 1961). They include both fleshy and hair-like types. The number of these setae varies considerably individually and within the family. The fleshy setae are usually numerous (up to 54) in the *COCCUS* group and less numerous (up to 25) in the *ERIOPELTIS* and *INGLISIA* groups ; they are absent in the *EULECANIUM* group with the exception of *S. prunastri*, which has 7–16 setae. The hair-like setae are never more than 4 in number and are often entirely absent.

In *Ctenochiton* sp., *C. hesperidum* and Genus *B* a number of circular pores, somewhat reminiscent of vacant hair sockets, are situated on each side dorsally, posterior to the pronotal ridge. They number 3–7 (average 6·1), 0–1 (average 0·4) and 2–5 (average 3·6) respectively.

Mesothorax

The mesothorax, as the principal wing-bearing segment, is well developed and sclerite degeneration is much less pronounced than in the other thoracic segments ; in addition, some of the sclerites are bounded by strong ridges. The shape of the sclerotized areas varies comparatively little within the family and consequently provides only a few characters of taxonomic importance.

Mesotergum. The usual subdivisions of the mesotergum can easily be discerned. Thus the notum (or alinotum) is widely separated from the postnotum, the former being distinctly subdivided into a prescutum, scutum and scutellum ; this was already recognized by Šulc (1932), Pesson (1941) and Jancke (1955).

The *prescutum* (prsc) is situated anteromedially and is surrounded laterally and posteriorly by the scutum. It has the shape of a large subrectangular bulge. Anteriorly it curves sharply downwards and forms the *mesoprephragma* (Text-figs. D) ; the latter has the shape of a simple lamina with the inner margin slightly emarginated in the middle. This emargination varies somewhat individually, but it is inconspicuous or absent in some species (e.g. *E. ?festucae*, Text-fig. 26, D) and pronounced in others (e.g. *C. hesperidum* and Genus *B* ; Text-figs. 31, 33 ; D). The phragma was regarded as the prescutum by Ezzat (1956). Laterally the prescutum is separated from the scutum by strong *prescutal ridges* (pscr), which are fused anteriorly with the mesoprephragma, and extend posteriorly for some distance along the sides of the membranous area of the scutum. The posterior margin is bounded by the *prescutal suture* (pscs) with its corresponding internal ridge. The median part of the prescutum is often more heavily sclerotized and sometimes a median, ridge-like structure occurs at the posterior (*P. bituberculatum*, Text-fig. 10) or near the anterior margin (*Ceroplastes* spp.). In some species the cuticle of the prescutum shows reticulation, which may be regularly polygonal (e.g. *P. piceae*, *L. luzulae*, *Parthenolecanium* spp. ; Text-figs. 6, 27, 38 and 39) or irregular (*C. hesperidum*, Genus *B* ; Text-figs. 31, 33). The prescutum has been called the " scutum of the prothorax " (Putnam, 1879), the " proscutum " (Jancke, 1955) and the " scutum " (Ezzat, 1956).

The *scutum* (sct) has a rather curious shape. The median membranous area, which is comparatively small in the margaroid *Pseudaspidoproctus* and *Steingelia* (Theron, 1958), has in this family become so expanded that it completely and widely separates the two lateral sclerotized parts. These extend anteriorly along the sides of the prescutum and posteriorly along the sides of the scutellum. In the anterolateral region the scutum is produced into a *prealare* (pra), which is separated from the former by an internal lamina. The prealare is semitubular in shape, with the more heavily sclerotized and infolded anterior margin continuous with the mesoprephragma. The distal part of the prealare is differentiated into a heavily sclerotized, convex *triangular plate* (tp), which extends to the episternum. Behind the prealare the lateral margin of the scutum is infolded and somewhat more heavily sclerotized, the infolded section of the margin terminating in a small rounded projection which constitutes the *anterior notal wing process* (anp). From this level the posterior extension of the scutum is depressed, laterally emarginated and with a rounded posterior lobe which can be regarded as the *posterior notal wing process* (pnp). The posterior margin of the scutum probably incorporates the lateral part of the so-called marginal fold of the notum ; posterolaterally it is attached to the postalare by means of a sclerotized band. Part of the scutum adjacent to the scutellum is more heavily sclerotized and usually reticulated. This probably led Theron (1958) to misinterpret it as part of the scutellum, as indicated in his illustration of *P. pomeranicum*. The anterior part of the scutum may also show reticulation (e.g. *Ceroplastes* spp., Text-figs. 41, 43) and even the median membranous area may be weakly reticulated (*Eriopeltis* sp., *L. luzulae* ; Text-figs. 24, 27).

The *scutellum* (scl) in dorsal view has the shape of a transverse rectangle. The anterior and posterior edges, constituting the scutoscutellar ridge and the posterior marginal fold of the notum respectively, curve sharply inwards, are deflected under the scutellum and extended internally. The inner edges usually have become intimately fused, leaving only an oval median *foramen* (sclf) (*F. viburni*, *Ctenochiton* sp., *S. prunastri*, *ERIOPELTIS* group, *COCCUS* group). This gives the scutellum the appearance of a dorsoventrally flattened tube. In some species, however, the inner edges do not unite with each other (*I. theobromae* and most species of the *EULECANIUM* group). In the species where the scutellum is tubular it is usually shorter and wider than in those where the scutellum is not tubular. The scutellum was called the " apodema " by Putnam (1879), Green (1904–1909) and Dürr (1954) while Habib (1956), Borchsenius (1957) and Bustshik & Saakjan-Baranova (1962) regarded it as part of the scutum. The scutellar foramen was referred to as a " membranous area " by Pesson (1941), Jancke (1955), Ezzat (1956) and Borchsenius (1957). Bustshik & Saakjan-Baranova (1962) state that it is absent in *C. hesperidum*.

The scutellum is followed by a large, subtriangular membranous area which separates it from the postnotum. This membranous area was regarded as the scutellum by Putnam (1879), Green (1904–1909), Habib (1956) and Borchsenius (1957), and as the postnotum by Šulc (1932), Pesson (1941) and Jancke (1955). The *postnotum* (pn_2) is a curved structure which extends deeply into the metathoracic cavity and is overlapped by the similarly inflected metanotum. The anterior margin

of the postnotum is usually weakly sclerotized and irregular, and may be exposed (e.g. *P. myrtilli*, *Ctenochiton* sp., *Eriopeltis* spp, *Ceroplastes* spp. ; Text-figs. 12, 16, 24 & 26, 41 & 43) or medially overlapped by the metathoracic fold (e.g. *E. tiliae*, Genus *A*, *I. theobromae* ; Text-figs. 2, 20, 29), but this varies somewhat individually. Anterolaterally the postnotum bears a deep finger-like *apophysis* (pna). Sometimes the whole postnotum is polygonally reticulated (*Ceroplastes* spp.) or reticulation occurs near the anterior margin only (*P. corni*). At the posterior margin of the postnotum a mesopostphragma is formed which is usually deeply emarginated medially. On each side the postnotum is produced into a strong *postalare* (pa), which extends anterolaterally to articulate with the mesopleural ridge. The *anterior postalar ridge* (apar) is well developed, while the *posterior postalar ridge* (ppar) is weak. The anteroventral part of the postalare is densely reticulated. Dorsally the postalare is produced into two small processes ; the hind margin of the wing is attached to the anterior one, and the posterior marginal fold of the notum to the posterior.

Mesopleuron. A striking feature of the mesopleural region is the strong *mesopleural ridge* (plr_2). The ridge winds obliquely across the pleuron, with a sharp bend which separates the strongly developed vertical part from the weaker ventral section, the latter extending obliquely towards the coxa. The dorsal part of the ridge gives firm support to the pleural wing process, the ventral extremity articulates with the coxa. The ventral part is partly overlapped by the postalare and at this point a *pleural apophysis* (pla_2) is invaginated. In some species (e.g. *F. viburni*, *Ctenochiton* sp., *E. pela* ; Text-figs. 15, 17, 19) the ridge fades away into the pleural sclerite, as is also the case in the margaroid *Steingelia* (Theron, 1958) and some Pseudococcidae (Giliomee, 1961). The *pleural wing process* (pwp_2) is a large rounded structure. On its lower anterior margin there is a small tendon-like *apodeme* (t) from which a muscle extends anterodorsally to the tegula. Posterodorsal to the pleural wing process a small, meniscate *subalare* (Text-figs. 1, A_1, sa ; 18, N, sa ; 18, P) is found. Dorsally it is produced into a finger-like process, which apparently articulates with the second axillary sclerite (Text-fig. 18, N). The *basalare* (bas) is a narrow but distinct sclerite (in the *EULECANIUM*, *ERIOPELTIS* and *INGLISIA* groups) which connects the anterior margin of the wing process with the episternum, or it is vestigial and incorporated into the pleural wing process (in the *COCCUS* group). The vertical part of the pleural ridge is separated from the episternum by a strip of membrane which corresponds to the basalar cleft of Matsuda (1960). The *episternum* (eps_2) is large and well sclerotized ; a membranous cleft, extending anteriorly from the region of the pleural apophysis completely divides it into dorsal and ventral parts. The dorsal part is strongly convex and sometimes reticulated (e.g. *C. hesperidum*, *Ceroplastes* spp ; Text-figs. 17, 40 & 42) ; the ventral part is a narrow elongated sclerite which joins the lateropleurite anteriorly. The dorsal part is bounded anteriorly by a well developed *subepisternal ridge* (ser). This ridge extends dorsally from the triangular plate of the prealare towards the marginal ridge of the basisternum. Below the membranous cleft, however, it is reduced and only marked

by a band of darker sclerotization. The *lateropleurite* (lpl) is always well developed and the anterior margin often bounded by an extension from the anterior part of the marginal ridge (e.g. *E. tiliae, L. luzulae, I. theobromae ;* Text-figs. 2, 27, 29). The *epimeron* (epm_2) is represented by a small sclerite posterodorsal to the coxal articulation. The *mesothoracic spiracle* (sp_2), with its supporting *peritreme* (ptr_2), is situated in the membrane anterior to the subepisternal ridge. Except for Theron (1958), none of the earlier workers on the Coccidae studied the mesopleuron in any detail. Ezzat (1956) referred to the subepisternal ridge as the " pleural bridge " and to the pleural ridge as the " pleural sclerite ". It is difficult to determine with certainty the homologies of the structures described above with those of the basic pleurosternal region, as proposed by Matsuda (1960). The membranous cleft probably represents or incorporates his anapleural cleft. According to his definitions, the dorsal part of the episternum then represents the anepisternum (called pre-episternum by Weber, 1928) and the ventral part of the pre-episternum, with the katepisternum either absent or incorporated into the latter. Theron (1958), following Weber (1928), referred only to the area anterior to the ventral part of the subepisternal ridge as a lateropleurite (pre-episternum). Roberti (1946) called the same area a laterosternite, a term used by Weber (1928) to describe a more ventral part of the precoxal region.

Mesosternum. The mesosternum is almost entirely represented by the large hexagonally shaped *basisternum* (stn_2). At the junction of the basisternum and episternum there is a strong *marginal ridge* (mr), which extends medially to delimit the basisternum anteriorly. Posteriorly it unites with the precoxal ridge and further posteriorly the ridge fuses with the pleural ridge immediately above the coxal articulation. The strong *precoxal ridge* (pcr_2) curves round the posterolateral edge of the basisternum, but fades away before reaching the median line. A strong longitudinal *median ridge* (mdr) completely divides the basisternum into two halves ; sometimes, the ridge is more or less reduced (*Eriopeltis* spp. ; Text-figs. 24, 26) or vestigial (*I. theobromae ;* Text-fig. 29). The posterior margin of the basisternum is invaginated to form a transverse *furcal pit* (fp) from which a well developed *furca* (f) originates. The furca consists of a broad basal stalk and two strong furcal arms. No separate sternellum is found ; Mäkel (1942), from a study of some Pseudococcidae suggested that it is represented by the base of the furca. The sclerite which Ghauri (1962) regards as the sternellum in the Diaspididae is probably part of the metathorax (as discussed later). Ezzat (1956) referred to the basisternum as the " furcasternum " and called the transverse part of the marginal ridge a " sternacostal suture "; Borchsenius (1957) called the basisternum a " mesosternal frame ".

Articulation of the wings. The articulation of the wing is facilitated by a number of minute alary sclerites or pteralia which lie embedded in the basal articular membrane of the wing (Text-figs. 1 ; 18, N). They consist of the tegula, the first, second and third axillary sclerites, and the additional sclerite. Other structures involved in the wing articulation are the anterior notal wing process, the pleural wing process, the epipleurites and the costal complex of wing veins.

The small, meniscate *tegula* (teg) is situated far anterior to the wing base, from which it is separated by a large membranous bulge. This bulge carries a small, weak sclerite posteriorly and in some cases (e.g. the *ERIOPELTIS* group) it is weakly reticulated. The *first axillary sclerite* (Text-figs. 1 ; 18, N ; ax_1) is triangular in shape and its mesal edge lies against the lateral margin of the scutum just behind the anterior notal wing process. The anterior part of the sclerite is drawn out into a slender arm, which curves round the anterior apex of the second axillary sclerite and articulates with the costal complex of wing veins. The posterolateral part of the sclerite articulates with the second axillary sclerite. The first axillary sclerite rather closely resembles those of the more primitive Coccoidea described by Theron (1958). The *second axillary sclerite* (Text-figs. 1 ; 18, N ; ax_2) is elongate, slightly curved, with both the anterior and posterior apices acute. The anterior part articulates with the first axillary and the posterior apex with the third axillary sclerite. Apparently it also articulates with the subalare which lies directly below it. The structure of the *third axillary sclerite* (Text-figs. 1 ; 18, N ; ax_3) is more complex and it shows some variation in the species studied. The distal, somewhat triangular part articulates anteriorly with the posterior apex of the second axillary while its posterior margin is confluent with the hind margin of the wing. Mesally this plate extends into a narrow arm which is twisted in such a way that the plane changes from horizontal to vertical (Text-fig. 18, O) ; this arm has an anterior, scoop-like extension which is attached to a process on the postalare by means of a tiny axillary cord. In some species (e.g. *ERIOPELTIS* group, *C. hesperidum*, *Parthenolecanium* spp.; Text-figs. 24, 26, 27 and 31, 38, 29 ; I) this anterior extension is very small or absent. The *additional sclerite* (asc) is situated at the base of the wing immediately distal to the second and third axillary sclerites, but does not articulate with them. It is weakly sclerotized and irregularly elongate. As suggested earlier (Giliomee, 1961) this structure may represent the second median sclerite, defined by Snodgrass (1935).

The costal complex of wing veins will be discussed later.

Chaetotaxy. Both fleshy and hair-like setae may occur on the mesothorax. Setae are found on the scutum, scutellum, tegular bulge, the membrane anterior to the basisternum and episternum, and on the basisternum itself. No setae were found on the prescutum.

(i) The *scutal setae* (sctse) are scattered over the median membranous area of the scutum. In some species (*Ceroplastodes chiton* Green, and sometimes in *E. ?festucae*) they also extend beyond the posterolateral corner of the membranous area to occur on the sclerotized parts. In a number of species (*INGLISIA* group and most species of the *COCCUS* group) the scutal setae comprise both fleshy and hair-like setae in various proportions, but usually in fair numbers (e.g. 10–32, average 24 fleshy setae in *C. hesperidum* and 14–22, average 18 hair-like setae in Genus *B*). In the other species the scutal setae are either absent (*E. tiliae*, *N. abietis*, *P. piceae*, *R. spiraeae* and *E. pela*) or consist of hair-like setae only ; the hair-like setae may be few (up to 4) in some species (*P. bituberculatum*, *P. myrtilli*, *S. prunastri*) and numerous (up to 30) in others (e.g. *Pulvinaria* spp.).

(ii) *Scutellar setae* (scls). One or two hair-like setae are sometimes present on the scutellum, but their occurrence is very irregular and variable even within a species.

(iii) The *tegular setae* (tegs) are carried on the anterior part of the tegular bulge and consist usually of a small number (up to 11) of hair-like setae. Fleshy tegular setae were only observed in *Ceroplastodes chiton* Green and occasionally in *I. theobromae*.

(iv) The *postmesospiracular setae* (pms) are arranged in a broad band on the membane posterior to the prosternum and mesothoracic spiracles. When they are numerous, some setae may also occur on the episterna. They consist almost entirely of fleshy setae and are only present in the *COCCUS* and *INGLISIA* groups. Their numbers vary from 14–29 (average 21) in *Ceroplastes* to 71–97 (average 89) in *P. corni*.

(v) The *basisternal setae* (stn_2s) are situated on or near the median ridge in the posterior part of the basisternum. They were found in only 3 species, consisting of 1 or 2 hair-like setae in *N. abietis* and *P. piceae* (Text-figs. 4, 6) and 2–9 (average 5) fleshy setae in Genus *B* (Text-fig. 33).

Metathorax

The metathorax is very weakly sclerotized and the sclerites have to a large extent been replaced by membrane ; this is due to the reduction of the hind wings. The metanotum, however, is relatively well developed. It consists of a large plate which closely overlaps the invaginated mesopostnotum. The dorsal edge (morphologically posterior margin) of the sclerite is heavily sclerotized, forming a ridge-like structure which usually extends continuously from one side to the other, but in a number of species (e.g. *E. tiliae*, *F. viburni*, *Ceroplastes* spp.) its median part is somewhat desclerotized. Externally the metanotum is represented by a small, lateral *suspensorial sclerite*, which is connected to the haltere by means of a sclerotized band. The suspensorial sclerites are absent when the halteres are lacking. Somewhat more posteriorly an additional, small, weak sclerite is sometimes present (e.g. in *E. tiliae*, *L. luzulae*, *P. corni*, Text-figs. 2, 27, 38), but it may be absent or present within the same species. In the intersegmental region between the metathorax and 1st abdominal segment there is an irregular, transverse, lateral sclerite which corresponds to the acrotergite or *postnotum* (pn_3) of the more primitive Coccoidea (see Theron, 1958). In one of the species (*L. luzulae*, Text-fig. 27) the sclerites of the opposite sides meet or closely approximate each other, and in another species (*I. theobromae*, Text-fig. 29) they are divided by the intersegmental line.

The degree of development of the pleural region depends to a considerable extent on the absence or presence of halteres. The *pleural ridge* (plr_3) extends from the coxal articulation in an anterodorsal direction across the pleuron. When the haltere is absent (e.g. *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups) the ridge only extends for a short distance above the coxal articulation. When the haltere is present, however, (most of the *EULECANIUM* group), it extends towards the base of the haltere where it is slightly expanded to form a small *metapleural wing process* (pwp_3). In this condition the ridge becomes weaker or is interrupted at about halfway from the coxal articulation ; a shallow depression in this area appears to represent a reduced *metapleural apophysis* (pla_3).

The *episternum* (eps_3) is small and subtriangular in shape, but when the haltere is present it expands in a ventral direction ; in some species (e.g. *E. tiliae* and *R. spiraeae ;* Text-figs. 3, 9) its anterior margin is partly bounded by a more or less developed ridge, resembling the subepisternal ridge of the mesothorax. The *epimeron* (epm_3) is represented by an irregular, posteriorly produced sclerite. In most species a vestigial *precoxal ridge* (pcr_3) extends anteriorly for a short distance along the ventral margin of the episternum, but the absence or presence of this ridge varies individually. The *metathoracic spiracle* (sp_3), supported by a *peritreme* (ptr_3), is situated in the membrane anterior to the episternum.

The *metasternum* (stn_3) is usually represented by a fairly large, irregular, median plate, which is generally more heavily sclerotized anteriorly and weaker posteriorly, but in some species (e.g. *S. prunastri*, Text-fig. 22 ; *Ceroplastes* spp., Text-figs. 41, 43) its posterior part is entirely membranous and only a narrow strip of it remains anteriorly. In *Eriopeltis* sp. (Text-fig. 13) small and irregular sclerotized areas are situated anterior to this plate. The sternal apophyses are absent and this makes it difficult to establish the homologies of the metasternal structures. The rather similar topographical conditions in the Pseudococcidae, in which the metasternal apophyses are present (Giliomee, 1961), indicate that the large metasternal plate of the Coccidae represents a sternellum and that the small sclerites found in *Eriopeltis* sp. corresponds to a basisternum. This conclusion is supported by the position of the sternal apophyses and the large sternellum in *Margarodes* (Theron, 1958), and the general structure of the meso- and metasterna in *Aphis* (Weber, 1928). Ghauri's (1962) interpretation of corresponding sclerites in the Diaspididae as a metabasisternum and mesosternellum respectively, consequently appears to be incorrect.

Habib (1956) recognized the inverted nature of the metanotum ; Ezzat (1956) and Borchsenius (1957) illustrated the pleural sclerotization but do not discuss it in any detail ; Theron (1958) overlooked the postnotal and sternal sclerites in *P. pomeranicum.*

Dermal structures. The fleshy and hair-like setae are arranged in the following groups:

(i) *Metatergal setae* (mts), occurring laterodorsally, anterior to the postnotal sclerite. They usually consist of a single hair-like seta on each side, but in the *INGLISIA* and *COCCUS* groups (Text-figs. 29–43) up to 10 fleshy setae may also be present in this region. In *Ceroplastes* spp. only fleshy setae are present and in *E. tiliae, P. piceae, E. pela* and Genus *A* no metatergal setae were observed. The setae of this region are sometimes difficult to observe because of the heavy sclerotization of the invaginated structures which lie directly underneath.

(ii) *Dorsospiracular setae* (dss), which are situated pleurally, dorsal to the metaspiracle and in line with the pleural setae of the abdomen. When they are numerous they are sometimes difficult to separate from the metatergal setae. They are only present in the *INGLISIA* and *COCCUS* groups. The number of fleshy setae varies from 1–8 (average 3·6) in *I. theobromae* to 10–23 (average 15) in *P. acericola ;* hair-like setae are rarely present and never total more than 3.

(iii) *Antemetaspiracular setae* (ams), which are found immediately anterior to the metaspiracle and consist entirely of fleshy setae (up to 12). They are present only in the *INGLISIA* and *COCCUS* groups.

(iv) *Postmetaspiracular setae* (eps_3s), which occur in the pleural region posterior to the metaspiracle, partly on the metepisternum, and may extend ventrally towards the metasternum without reaching it. The fleshy setae are generally numerous in the *COCCUS* group (up to 35 in *P. corni*), but few in the other groups and absent in some species of the *EULECANIUM* group (e.g. *E. tiliae*). The hair-like setae occur irregularly and in small numbers (0–3), but in *E. pela* they are always present (4–8, average 5·6).

(v) *Anterior metasternal setae* (amss), situated in the membranous area between the meso- and metasternal plates. Fleshy setae are present in the *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups (Text-figs. 24, 43) and in *S. prunastri* (Text-fig. 22) of the *EULECANIUM* group. Their number varies from 8–17 (average 12) in *E. ?festucae* to 74–94 (average 86) in *P. corni*. A few hair-like setae are present in some individuals of most species.

(vi) *Posterior metasternal setae* (pmss), occurring on the metasternal plate, or in the area normally occupied by this sclerite. Fleshy setae are found in the *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups (Text-figs. 24–43) where their number varies from 5–16 (average 8) in *I. theobromae* to 31–60 (average 42) in *P. corni*. In *S. prunastri* (*EULECANIUM* group) up to 3 fleshy setae may be present in some individuals, but are absent in others. A few hair-like setae (up to 3) may be present in some individuals of a number of species.

In *Ctenochiton* sp. 3–11 (average 6·3) circular pores, somewhat reminiscent of vacant hair sockets, occur near the metatergal seta on each side.

Wings and Halteres

The *fore wings* are large, with a narrow basal part and a broadly rounded apex. They may be relatively short and broad, i.e. the length 1·9–2·3 times the width (e.g. the *COCCUS* group), or long and narrow, i.e. the length 2·8–3·3 times the width (e.g. the *ERIOPELTIS* group, Text-figs. 24, 26, 27). Posteriorly, near the base, a small pouch or *alar lobe* (al) (Stickney, 1934b) is formed by the dilation of the margin of the wing. It is ventrally invaginated and provides a receptacle for the hooked distal ends of the apical setae of the haltere. When the haltere is lacking the alar lobe is absent.

The wing is semitransparent, although in some species, e.g. *P. bituberculatum*, the area between the anterior margin and the first wing vein has a purplish tinge. The surface of the wing is covered with minute hairs (microtrichia), with those on the margins somewhat longer than elsewhere. Only two distinct veins are present. Patch (1909) suggested that corresponding veins in the Pseudococcidae represent the *radius* (rad) and *media* (med) ; these veins were also called radius and " medius + subcosta " by Dürr (1954), but the last mentioned designation is obviously incorrect. The radius runs parallel to the anterior margin of the wing, the media deflects towards the hind margin. As in the Pseudococcidae (Patch, 1909) the two

veins are not visibly connected. At the base of the wing, near the anterior margin, an elongate sclerite forms the *costal complex of veins* (Text-fig. 1 ; 18, N ; ccx). The proximal part of the sclerite is pointed and articulates with the anterior notal wing process. Near the base an anterior extension is found which curves ventrally (see Text-fig. 18, N) to articulate with the pleural wing process. A small number of hair-like *alar setae* (as) are found in the anterior part of the base of the wing in *E. tiliae*, *N. abietis*, *R. spiraeae* and *Ctenochiton* sp. (Text-figs. 2, 4, 8, 16). Their number does not exceed 3 ; they are sometimes absent on one of the two wings.

The hind wings are either absent (*P. myrtilli*, *S. prunastri*, the *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups ; Text-figs. 12, 22–43) or reduced to *halteres* (h) (most of the *EULECANIUM* group). The anterior half of the haltere is weakly sclerotized and near the base the anterior margin is strengthened by a ridge, which resembles a wing vein. At the apex each haltere carries at least one long seta, but in *E. tiliae*, *N. abietis*, *R. spiraeae*, *P. piceae* and *E. pela* (Text-figs. 2–9) three or four may be present. These setae are curved apically and hook on to the alar lobe. It is worthy of note that the halteres of *Margarodes* (see Theron, 1958) resemble the hind wings of certain Aphididae, e.g. *Anomalaphis comperi* and *Microparsus variabilis* (see Baker, 1920) to a considerable degree, presumably through convergence. The halteres were called " pseudohalteres " by Kawecki (1958b), and recently (1964) he suggested the term " hamulohalterae " for these structures.

Legs

The three pairs of legs are very similar, long and slender, and composed of the usual segments, with a one-segmented tarsus and a single claw. The fore legs are usually the shortest and the hind legs the longest, but conditions vary and there are species in which the hind or the middle legs are the shortest. All the segments of the leg are well sclerotized and all except the claw are covered with numerous *fleshy* (fs) and *hair-like* (hs) *setae*, although the fleshy ones are sometimes absent on the tarsus (Genus *A* and *E. ?festucae*). They are not arranged into groups, but scattered over the whole surface of the segment. These setae are similar to those occurring elsewhere on the body. Conforming with the conditions on the antennae, the fleshy setae of *E. pela* are very long, from 3 to 5 times as long as the width of the tibia, and in Genus *A* they are very short, about $\frac{3}{4}$ as long as the width of the tibia ; in the other species they are slightly longer than the width of the tibia. In *E. tiliae* the fleshy setae are very thin and it is difficult to distinguish them with certainty from the hair-like setae. The hair-like setae are very similar in all the species studied and are usually a little longer than the width of the tibia. Distinctly different setae occur on the inner margin of the anterior coxae of some species. They are large, rigid, sometimes capitate, with the setal membrane surrounded by a distinct basal ring ; they are here called *coxal bristles* (cb), and are probably sensory in nature. A pair of *tarsal digitules* (tdgt), i.e. long, capitate setae, is present near the dorsal apex of each tarsus and two smaller *ungual digitules* (udgt) occur on each claw.

The *coxa* (cx) is short and broad. Its base is strengthened by a well sclerotized basal ridge which articulates dorsally with the pleural ridge by means of a short basal process. The apical margin is also ridge-like and bears an anterior and a posterior process, which articulate with corresponding processes on the trochanter. The hair-like setae on the coxae vary considerably in length, those near the basal process being very short and those near the apex being longer. The longest seta on the inner terminal part, called the *apical seta* (ase) may be short, i.e. length about half that of the trochanter (e.g. *E. tiliae*, *F. viburni*, *Pulvinaria* spp. ; Text-figs. 2, 14, 35 & 37) or long, i.e. as long as the trochanter (*ERIOPELTIS* group ; Text-figs. 24, 26, 27). Coxal bristles were found in some species of the *EULECANIUM* group (e.g. *E. tiliae*, *N. abietis* ; Text-figs. 2, 3 ; M ; cb) and all the species of the *COCCUS* group (Text-figs. 31, 33, 35, 37, 38, 41 ; M ; cb), except *C. berliniae*. They appear to be capitate in all the species of the *COCCUS* group except *P. pomeranicum* and pointed in most species of the *EULECANIUM* group ; in some specimens of *E. tiliae* both capitate and pointed bristles may occur. The number of coxal bristles varies from 1–2 (average 1·4) in *P. bituberculatum* to 5–8 (average 6·2) in *E. tiliae*.

The *trochanter* (tr) is elongate, narrow basally and broad distally. The strong basal ridge bears an anterior and posterior articular process and continues for some distance along the outer margin. The trochanter is separated from the femur by a narrow membrane. A minute hair-like seta occurs both anteriorly and posteriorly in the membrane near the basal ridge and a small rigid seta is always present on the outer margin. These setae appear to be proprioceptors. Ventrally near the apex there is usually one, but in some species (e.g. *E. tiliae*, *P. piceae*, *R. spiraeae*) two long hair-like setae. The longest seta, the *apical seta* (ase), may be comparatively short, i.e. less than $1\frac{1}{2}$ times as long as the width of the trochanter (Genus *A*, *C. hesperidum* ; Text-figs. 20, 31) or long, i.e. more than 3 times as long as the width of the trochanter (*E. tiliae*, *N. abietis*, *Eriopeltis* spp., Text-figs. 2, 4, 24 & 26). A ring of oval campaniform sensilla are found in the basal half of the trochanter. They are usually 6 in number, but in *E. pela* up to 8 may be present.

The *femur* (fm) varies in shape from being long and narrow, i.e. 6 times longer than wide (*C. hesperidum*, Genus *B* ; Text-figs. 31, 33) to short and broad, i.e. $3\frac{3}{4}$ times longer than wide (Genus *A*, *S. prunastri* ; Text-figs. 20, 22). The distal ridge is well developed and bears an anterior and posterior process which articulate with corresponding processes on the tibia. All the setae are of the ordinary fleshy and hair-like types.

The *tibia* (tib) is long and slender. The width/length ratio varies from about 1 : 11 in *S. prunastri* and *L. luzulae* (Text-figs. 22, 27) to about 1 : 21 in *C. hesperidum* (Text-fig. 31). Basally it articulates with the femur by means of two processes and distally it is connected to the tarsus by means of a narrow, articular membrane, without a sclerotized joint being formed. The relative numbers of fleshy and hair-like setae vary ; in the *COCCUS* and *INGLISIA* groups and some species of the *EULECANIUM* group the fleshy setae are more numerous and in the *ERIOPELTIS* group and some species of the *EULECANIUM* group the hair-like setae are more

numerous. On the inner margin, near the apex, an *apical spur* (tibs) is present in all the species studied. In some species, e.g. *E. pela*, some of the hair-like setae near the apex also have a spur-like appearance. In *I. theobromae* the apical spur on the front leg is short, about half as long as on the other tibiae.

The *tarsus* (tar) is elongate; the length varies from being about 3 times longer than wide (*P. piceae*, Text-fig. 6) to about 9 times that (Genus *B*, Text-fig. 33). The tarsus is broadest near the base or in the middle and tapers distally. Distally it articulates with the claw by means of a small dorsal process. As is the case with the tibia, there are more fleshy than hair-like setae in some species and more hair-like than fleshy setae in others. In Genus *A* the fleshy setae are completely absent on the middle, hind and sometimes front tarsi, while they are sometimes absent on the tarsi of *E. ?festucae*. Two long, subequal, capitate *tarsal digitules* (tdgt) are found dorsally near the apex.

The *claw* (cl) is well developed, curved, pointed, with a small denticle ventrally near the apex. In some species, e.g. *P. myrtilli* and *C. hesperidum* the denticle is minute. Each side of the base of the claw bears a capitate *ungual digitule* (udgt), which is usually about as long as the claw. The claws on all three legs are subequal and they show little variation within the family.

Most of the earlier workers give brief descriptions of the leg. The tarsal and ungual digitules were already observed by Putnam (1879).

The Abdomen

The abdomen is elongated, more or less parallel sided, with the posterior end tapering and carrying the narrow and sclerotized genital segment. In cross section it is strongly convex ventrally and only moderately so dorsally. In most of the species the pregenital segments are almost completely membranous. The segmentation is not very distinct, but it is indicated by shallow intersegmental grooves, and the segmental arrangement of the setae and transverse bands of minute dermal denticulations. These denticulations, which are also present in male Diaspididae (Ghauri, 1962), Pseudococcidae and some female Coccoidea and Aphididae, occur on the dorsal and ventral surfaces of the median part of each segment. The abdomen is composed of eight pregenital segments and the 9th or genital segment; this was recognized by Putnam (1879), Silvestri (1919a, 1919b, 1920), Šulc (1932), Pesson (1941), Borchsenius (1957), Theron (1958) and Bustshik & Saakjan-Baranova (1962).

Pregenital Segments

The 1st segment is developed dorsally and pleurally, but not ventrally ; the other segments are complete. The sclerotization of the abdomen varies considerably within the family. Where it is most fully developed, as in *E. tiliae*, *N. abietis*, *P. piceae*, *P. myrtilli* and *L. luzulae* (Text-figs. 2, 4, 6, 12, 27) tergal and sternal plates are found on all the abdominal segments. In other species (*P. bituberculatum*, *F. viburni*, *Ctenochiton* sp., *Eriopeltis* spp., *I. theobromae* and *P. ?betulae* ; Text-figs. 10, 14, 16, 24 & 26, 29, 35) sternites are present on all the segments, but tergites are absent on one or more of the middle segments and in the remaining species both tergites and sternites are absent on these segments.

The *tergites* (at) of segments I–III are situated in the intersegmental or antecostal region and they usually consist of a small transverse sclerite on each side. Those in front of segment I are enlarged and can perhaps best be regarded as the postnotum of the metathorax ; in the other segments they can be regarded as belonging to the segments posterior to them (similar tergites in *Planococcus* (Theron, 1958) and *Pseudococcus* (Giliomee, 1961) are probably also intersegmental and do not belong to the preceding segments as has been indicated). In some of the species, e.g. Genus *B*, *Pulvinaria* spp. (Text-figs. 33, 35 & 37) the tergites of segments II–III consist of a small sclerite on each side and a separate additional median sclerite, but in Genus *A* and sometimes in *P. myrtilli* there is a continuous transverse median sclerite. In segments IV–VIII the tergal plates are large, transverse and situated in the middle of each segment.

The *sternites* (as) also consist of large, transverse, segmental plates. In the more anterior and posterior segments they are usually complete, but in the intermediate segments they are either interrupted or completely absent. In some of the intermediate segments the membrane near the segmental boundary is bulging and irregularly folded.

Pleural sclerotization is only found on the caudal extensions of segment VII of the *ERIOPELTIS* and *COCCUS* groups (Text-figs. 24–43), on the caudal extensions of VIII in the *COCCUS* group, and in the pleural region of the *INGLISIA* group (Text-fig. 30). In *I. theobromae* a continuous band of sclerotization extends along the pleural region of segments IV–VII, with a small sclerotized area situated somewhat more ventrally on each of segments V–VI. This bears some resemblance to the condition in the winged female of *Aphis fabae*, where the lateral plates occur on abdominal segments II and VI (Weber, 1928) and, according to Weber, are morphologically part of the terga. This resemblance is probably merely superficial and devoid of any phylogenetic significance as no lateral sclerotization is present in any of the other Coccoidea studied so far.

In the *COCCUS* group, segment VII laterally bears a very prominent, tapering, *caudal extension* (ce). In the other groups this extension is small and broadly rounded or somewhat pointed. In the *COCCUS* and *ERIOPELTIS* groups they are weakly sclerotized lateroventrally. Theron (1958) incorrectly describes them as belonging to abdominal segment VIII and Šulc (1932) correctly illustrates the segmental position in one of his figures (fig. 23), but incorrectly in another (fig. 25). The *caudal extension* (ce) of segment VIII is also shaped in a variety of ways. It may form a small, simple lobe (the *ERIOPELTIS* group, the *INGLISIA* group and most of the *EULECANIUM* group), a papilla-shaped lobe (*Parthenolecanium* spp.; Text-figs. 38, 39 ; ♀), a large, straight, cylindrical lobe (*S. prunastri*, Text-fig. 22 ; *C. hesperidum* ; Text-fig. 31, ♀) or a somewhat geniculate lobe (Genus *B* ; Text-fig. 33, ♀), a mammillate lobe (*Pulvinaria* spp. ; Text-figs. 35, 37 ; ♀) or a prominent and semicircular lobe (*Ceroplastes* spp. ; Text-figs. 41, 43 ; ♀). In the *COCCUS* group the distal part of the lobe is weakly sclerotized and it bears a structure which is usually membranous but weakly reticulated; sometimes (*Cero-*

plastes spp.) it is weakly sclerotized in the middle. The structure, which can conveniently be called a *cicatrix* (c), varies in shape and relative size ; in *Ceroplastes* spp. it is large, circular and occurs dorsally ; in *C. hesperidum* and Genus *B* it is also large but occupies the posterior surface of the lobe and in *Parthenolecanium* spp. it is small and occurs apically. The caudal extensions resemble the fleshy tassels of some Monophlebidae (Morrison, 1928), presumably through convergence. Newstead (1916), in describing the male of *C. hesperidum*, referred to the caudal extensions of the 7th segment as " long slender hairy tubercles " and those of the 8th as " protruding gland-like processes ".

Dermal structures. Both fleshy and hair-like setae are present on the abdomen. They are segmentally arranged and occur in distinct groups on the dorsal, pleural and ventral surfaces and are referred to as abdominal dorsal (ads), abdominal pleural (dps and vps), and abdominal ventral (avs) setae.

The *dorsal setae* (ads) normally consist of 2 hair-like setae (one on each side) on all but segments II and III, but in *P. bituberculatum* and Genus *B* (Text-figs. 10, 33) they are regularly present on all segments. In addition to these a small but variable number of fleshy dorsal setae occur in the *ERIOPELTIS* and *COCCUS* groups (Text-figs. 24–43).

The *pleural setae* can be subdivided into a *dorsopleural* group (dps) and a *ventropleural* group (vps). These two groups are not in line with each other, the former being situated nearer to the posterior margin of the segment. When numerous the two groups coalesce to a certain degree ; on the 7th segment the two groups are not differentiated. The dorsopleural group consists of both fleshy and hair-like setae, occurring in different proportions and numbers in different species. In some species (most of the *EULECANIUM* group, Text-figs. 2–21) all dorsopleural setae are hair-like ; except for the *COCCUS* group, there are no fleshy setae on segments I–III, and frequently the anterior segments have no dorsopleural setae at all. The ventropleural setae usually consist of a single hair-like seta and none or but a few fleshy setae ; they are never found on I and rarely on segments II and III.

The *ventral setae* are arranged in a median group in the middle of each segment. They often consist of both fleshy and hair-like setae. The *hair-like* setae are always present, arranged on each side of the body into two longitudinal series, one median and one lateral, each series usually with one seta per segment. Both series are usually present on segments V–VII, but on segments II–IV either median or lateral setae are frequently absent, and on segment II hair-like ventral setae are often absent altogether (e.g. *L. luzulae*, *C. hesperidum*, *Ceroplastes* spp.). In most species (*S. prunastri*, *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups ; Text-figs. 22–43) *fleshy* ventral setae are also present. If present, they are usually numerous, except on segment VIII, but a comparatively large number (more than 5) on this segment is characteristic of the *INGLISIA* group. In *S. prunastri* fleshy setae occur only on segments II and sometimes III.

In addition to the above-mentioned setae, a number of setae are present on the posterior margin of segment VIII. Lateral to the glandular pouch this segment always carries 3 hair-like setae ; occasionally a fleshy seta may also be present,

but a comparatively large number (2–7) is characteristic of *Ceroplastes* spp. (Text-figs. 41, 43). In many species setae are present in the region anterior to the anus where, in some species, the small tergal plate of segment IX (mentioned later) is found ; these setae are called *ante-anal* setae (aas). In most of the species they consist of two long pointed hair-like setae, but in *Parthenolecanium* spp. one or both are sometimes bifurcate. In some genera (*Eriopeltis, Pulvinaria* and *Ceroplastes* ; Text-figs. 24 & 26, 35 & 37, 41 & 43) a number of fleshy setae are also present in this region, and in most species one or two small hair-like setae may occur in some individuals.

A group of small circular pores, reminiscent of vacant hair sockets, is found dorsally on each side of abdominal segment I of *Ctenochiton* sp. (Text-fig. 16) and a small number of these pores are also found in the ante-anal region in *Ctenochiton* sp., *L. luzulae* and Genus *B* (Text-figs. 16, 27, 33). On each side of the base of the penial sheath there is a funnel-shaped *pouch* (gp), which contains 2 long setae arising from its bottom. From about halfway up to the rim, the pouch is lined with numerous quadrilocular, but also with a few tri- and quinquelocular pores. According to Šulc (1931) the basal half of the pouch is lined with tubular pores. The pores secrete a waxy substance which slides along the setae and constitutes the conspicuous long waxy filament of the living male. The structure of the filament and pores was studied in detail by Šulc. In *Ctenochiton* sp., *E. pela*, Genus *A* and, as reported by Dürr (1954) in *Lecanium pumilum* Brain (= *Saissetia oleae* (Bern.) according to De Lotto (1959)) the setae are knobbed apically. The setae vary in length from short, i.e. the length of the protruding part only twice that of the part concealed within the pouch (e.g. *E. tiliae*, Text-fig. 2) to long, where the length of the protruding part is 4–6 times longer than the concealed section (e.g. *C. hesperidum*, Text-fig. 31). In *L. luzulae* the pouch is absent and replaced by a shallow depression with one long seta, but no pores at all. From available information it is known that the pouch is also reduced in *Vinsonia stellifera* (Newstead, 1903) and *Ceroplastes japonicus* (Borchsenius, 1957). The glandular pouch corresponds to what is called the "glandular plate" (Pflugfelder, 1939 ; Giliomee, 1961) in the Pseudoccidae.

Genital Segment and External Genitalia

The genital segment has become elongated to form a long tubular style which tapers posteriorly. The *anus* (an) is situated dorsally in the membrane at the basal part of the segment. The *penial sheath* (ps), which is composed of sternum IX (Theron, 1958), is well sclerotized laterally and membranous ventromedially. The lateral sclerotizations fuse dorsally with each other at some distance posterior to the anus. In some species (e.g. most of the *COCCUS* group) they are also narrowly joined anterior to the anus, a condition which obtains in the Diaspididae (Theron, 1958 ; Ghauri, 1962). The apex is sometimes produced into a small membranous extension, which is best developed and finger-like in *Ceroplastes* spp. (Text-figs. 41, 43 ; R). The ventral membrane widens anteriorly to form a triangular area which, for descriptive purposes, can be called the *basal membranous area* (bma). Posterior to this area a narrow ridge is formed on the median line, which appears

to be homologous to the basal rod (bra) found in other Coccoidea (see Theron, 1958, 1962), but was overlooked by Theron (1958) in *P. pomeranicum*. According to Theron the basal rod may incorporate the basal plate. Parameres are absent.

Posteriorly the basal rod is connected to the base of the *aedeagus* (aed), which is accommodated in a slit in the ventral wall of the penial sheath. The aedeagus consists of a straight tube, which does not narrow appreciably towards the apex. It ends bluntly before reaching the apex of the penial sheath. The ductus ejaculatorius can be seen to run along the ventral wall of the penial sheath, but the position of the gonopore is impossible to observe in mounted specimens. The aedeagus appears to contain an eversible endophallus, as is indicated by occasional specimens in which the everted condition has been observed. The genitalia with everted aedeagus, but considered to represent the normal condition, were illustrated by Šulc (1932). The relative length of the penial sheath, aedeagus and basal rod show considerable variation within the family. Silvestri (1919a, 1919b, 1920) and Jancke (1955) correctly illustrated and interpreted the aedeagus, while the illustrations given by Leonardi (1920) and Theron (1958) are inaccurate in some details ; Putnam (1879), Dürr (1954) and Husseiny & Madsen (1962) called the entire 9th segment either a penis or aedeagus.

In well stained specimens of some species (e.g. the *COCCUS* group ; Text-figs. 31–43) a small *9th tergite* (at_9) can be seen in the membrane anterior to the anus, but the 10th and 11th tergites described by Šulc (1932) were not observed.

Dermal structures. A number of small setae (gts), which are possibly tactile sensilla, are scattered over the genital segment. Distally the setae become considerably smaller and at the apex only small, circular discs can be discerned ; the latter may be campaniform sensilla.

DESCRIPTION OF THE SPECIES

In the descriptions of the individual species considerable detail has been included and they may well appear to be unduly long and repetitive. However, detailed descriptions are considered necessary since the taxonomic significance of the characters has, as yet, not been properly evaluated.

For the sake of brevity the usual telegraphic style of describing species has been adopted and the following abbreviations are used : h.s. = hair-like seta(e), f.s. = fleshy seta(e) ; the figures in brackets signify averages.

The *EULECANIUM* Group

EULECANIUM

Eulecanium tiliae (Linnaeus)

(Text-figs. 2 and 3)

Living specimens reddish, with sclerotized areas dark brown and the appendages light yellow, wings with a purplish tinge between anterior margin and first wing vein ; very long and moderately robust, with comparatively short antennae and legs which carry many setae.

When mounted, total body length 2440–2700 (average 2569) μ ; width at mesothorax 570–660 (average 601) μ. Wing expanse 3950–4550 (average 4296) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced ; length from apex to pronotal ridge 274–319 (average 303) μ, width across genae 296–338 (average 315) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 3–7 (average 5·3) hair-like *dorsal head setae*, arranged in two groups : one, with 2–4 (average 3·3) short setae, posterior to the level of the dorsal eyes, and the other with 0–4 (average 2) longer setae, anterior to the eyes. *Midcranial ridge* dorsally represented by a short, weak ridge anterior to the level of the eyes ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, with surrounding area showing weak, polygonal reticulation posteriorly. *Genae* large, sclerotized, weakly polygonally reticulated, without setae. *Eyes* : five pairs ; dorsal and ventral pairs large, subequal, lateral pairs smaller, subequal ; corneae of dorsal eyes 34–42 (average 38) μ in diameter and 2·2–2·9 (average 2·5) times as much apart ; those of the ventral eyes 32–42 (average 35) μ in diameter and 1·1–1·6 (average 1·3) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized except between the ventral eyes where the cuticle is produced into a keel ; polygonally reticulated throughout. *Preocular ridge* extending only a short distance below articular process. *Postocular ridge* very weak dorsally, sometimes missing posterior to ocellus ; well developed lateroventrally, but weak posteromedially ; below the ocellus the ridge splits up, with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent. *Ventral head setae* consisting of 1–5 (average 3·2) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* short ; apex bifurcate or occasionally truncate, not quite reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented ; filiform ; 895–1075 (average 988) μ long, i.e. shorter than half body length (ratio 1 : 2·46–2·92, average 2·62) ; shorter than posterior leg (ratio 1 : 0·73–0·87, average 0·80) and longer than penial sheath (ratio 1 : 1·16–1·50, average 1·31). *Scape* 57–68 (average 61) μ long and 57–67 (average 62) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 49–57 (average 54) μ long and 49–57 (average 53) μ wide, with 0–3 (average 1) f.s., 2–4 (average 2·9) h.s. and a sensillum placodeum. *Segment* III club-shaped, 1·8–2·2 (average 2) times longer than wide (84–106, average 90 μ long and 42–49, average 45 μ wide) ; with 4–12 (average 8·5) h.s. and 4–12 (average 5·8) f.s., the latter of medium length, 0·7–1·0 (average 0·9) times as long as width of segment ; with 4–9 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 114–171 (average 152), 137–160 (average 149), 106–148 (average 131), 95–122 (average 112), 80–95 (average 90) and 68–91 (average 78) respectively, widths varying from 30 to 42 μ, with distal segments wider than proximal ones ; with 18–53 (average 33), 33–55 (average 44), 26–46 (average 37), 28–43 (average 36), 22–32 (average 27), 18–34 (average 25) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX thicker than f.s. *Segment* X : terminal part not constricted ; 57–84 (average 72) μ long and 30–38 (average 33) μ wide ; carrying 8–14 (average 12) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about half as long as the segment and the 2 shorter ones about as long as the f.s., though thicker ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 806–901 (average 864) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* large, without setae. *Medial pronotal setae* absent. *Post-tergites* medium-sized, without striations and without setae. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, interrupted median ridge and a triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* 0–3 (average 0·8) h.s.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 268 and 138 μ respectively) ; anterior margin slightly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; sometimes with very weak polygonal reticulation. *Scutum*. *Median membranous area* transverse ; 80–106 (average

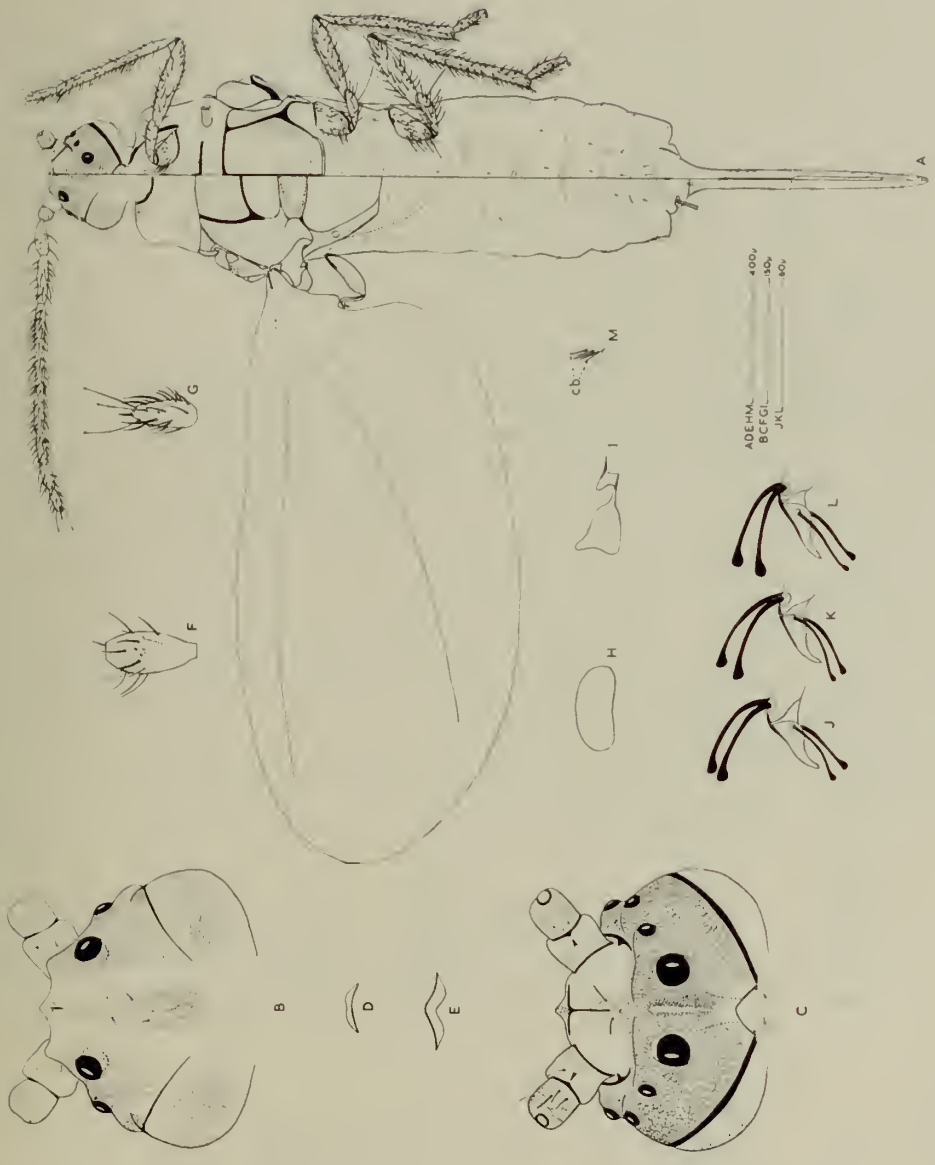


FIG. 2. *Eulecanium tiliae* (L.), dorsal and ventral view.

95) μ long and 2·06–3·00 (average 2·36) times as wide (width 203–251, average 223 μ) ; without setae. *Scutellum* 93–114 (average 107) μ long and 217–266 (average 236) μ wide, the ratio being 1 : 2·0–2·5 (average 2·2) ; not tubular and without setae. *Postnotum* with anterior margin usually irregular and partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with moderately deep emargination. *Mesopleuron. Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare. Subalare* small. *Episternum* not reticulated; *subepisternal ridge* well developed, becoming appreciably broader ventrally, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 383 μ wide and 287 μ long, i.e. 2·70–3·62 (average 3·04) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges. Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* comparatively large ; membranous bulge with a small weak sclerite posteriorly, with 6–10 (average 7·7) h.s. and sometimes showing wavy striations. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. Metanotum with thickening of posterior margin sometimes desclerotized medially ; *suspensorial sclerites* small, irregular ; a small additional sclerite always present anterior to postnotum. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* absent. *Pleural ridge* well developed, though interrupted near the middle ; with a small *wing process. Episternum* with anterior margin ridge-like in parts ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 0–2 (average 0·9) h.s. *Metasternal plate* weak and irregular. *Anterior metasternal setae* consisting of 0–2 (average 1·4) medial h.s. and occasionally with one or two lateral to the posterior part of the basisternum ; *posterior metasternal setae* usually 2 (range 1–3) h.s. medially.

Wings hyaline ; of medium length (1750–2000, average 1879 μ) but comparatively broad (width 780–870, average 840 μ), ratio width to length being 1 : 2·13–2·35 (average 2·24) ; *alar lobe* present ; *alar setae* : 1–3 (average 1·7) h.s. on each wing. *Halteres* well developed, 163–201 (average 178) μ long and 42–61 (average 53) μ wide, each with 2–4 (average 2·6) apically hooked setae which are about 70 μ long.

Legs short and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 2·07–2·15 (average 2·10). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	91–103	118–148	274–346	353–437	93–103	29–34	973–1094
	(95)	(128)	(301)	(391)	(98)	(30)	(1043)
II	99–118	120–133	251–308	433–479	114–133	29–34	1058–1203
	(110)	(129)	(285)	(450)	(124)	(32)	(1130)
III	106–141	125–143	281–315	456–532	125–148	30–34	1132–1303
	(124)	(134)	(295)	(499)	(134)	(32)	(1217)

FIG. 3. *Eulecanium tiliae* (L.), lateral view.

F.s. on the legs very slender, making it impossible to distinguish with accuracy between f.s. and h.s.

Coxae each with 24–35 setae ; fore coxa with 5–8 (average 6·2) coxal bristles, of which some are capitate ; apical seta about half as long as trochanter. *Trochanters* 34–44 μ wide ; with 6 oval sensilla ; with 16–25 setae, including 2 or 3 minute setae near basal ridge, one small seta on the outer margin and 2 long setae, of which the longest (apical) on the fore trochanter is 2·9–3·4 (average 3·1) times as long as width of trochanter. *Femora* of medium width (53–67 μ), ratio width to length of hind femur being 1 : 4·5–5·1 (average 4·9) ; each with 37–65 setae. *Tibiae* 29–38 μ wide, ratio width to length of hind tibia being 1 : 14·1–16·3 (average 15·1) ; each with 74–121 setae which are about as long as width of tibia ; apical spur of about the same size on all tibiae. *Tarsi* 28–34 μ wide, hind tarsus 4·1–4·9 (average 4·4) times longer than wide ; each with 18–37 setae ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; anterior *ungual digitule* with larger apical knob than posterior one, digitules longer than claw.

Abdomen 670–810 (average 713) μ long and 450–600 (average 521) μ wide.

Segments I–VII : *tergites* and *sternites* present on all segments ; tergites on segments II and III represented by a small sclerite on each side on the anterior margin, and on the IV–VII by a transverse plate ; sternites represented by a weak plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : f.s. absent ; h.s. absent on segment I, sometimes one or two present on each of the segments II–VII. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : 0–3 (average 1·3), 2–8 (average 3·8), 1–6 (average 3·5) and 2–6 (average 3·8) on segments III–VI respectively, and *ventropleural setae* : occasionally one on each of III and IV, and usually one on each of segments V and VI. Segment VII with 6–9 (average 7·4) h.s. *Ventral setae* : h.s. only, usually 2 medially on each of II and III, and 4 on each of segments IV–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long setae which are sometimes capitate and whose protruding part is about 1½ times as long as the section within the pouch. No IX tergite observed. *Anteanal setae* : 2 long h.s. Posterior margin with 2–4 (average 2·6) h.s. on each side.

Genital segment. Penial sheath long, about ⅔ total body length (ratio 1 : 3·3–3·7, average 3·4), 654–809 (average 756) μ long and 49–59 (average 55) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* ⅔–⅘ that of aedeagus, the rod extending anteriorly from base of aedeagus for ⅔–¾ of the distance to apex of basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 27–40 (average 35) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (300–376, average 349 μ), penial sheath longer and basisternum shorter, the ratios being 1 : 1·9–2·4 (average 2·2) and 1 : 0·71–0·96 (average 0·82) respectively.

Material examined : 10 specimens, bred in the laboratory from material collected by myself on horse-chestnut (*Aesculus hippocastanum* L.) at the Imperial College Field Station, Silwood Park, Sunninghill, Berks. ; males emerged during May, 1962. Five specimens collected by J. Řeháček in Bratislava, Czechoslovakia on 14.iv.53 (remounted from Swann's mountant) agreed well with the above description.

NEMOLECANIUM

Nemolecanium abietis Borchsenius

(Text-figs. 4 and 5)

A long, slender species with comparatively short antennae and legs ; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1930–2270

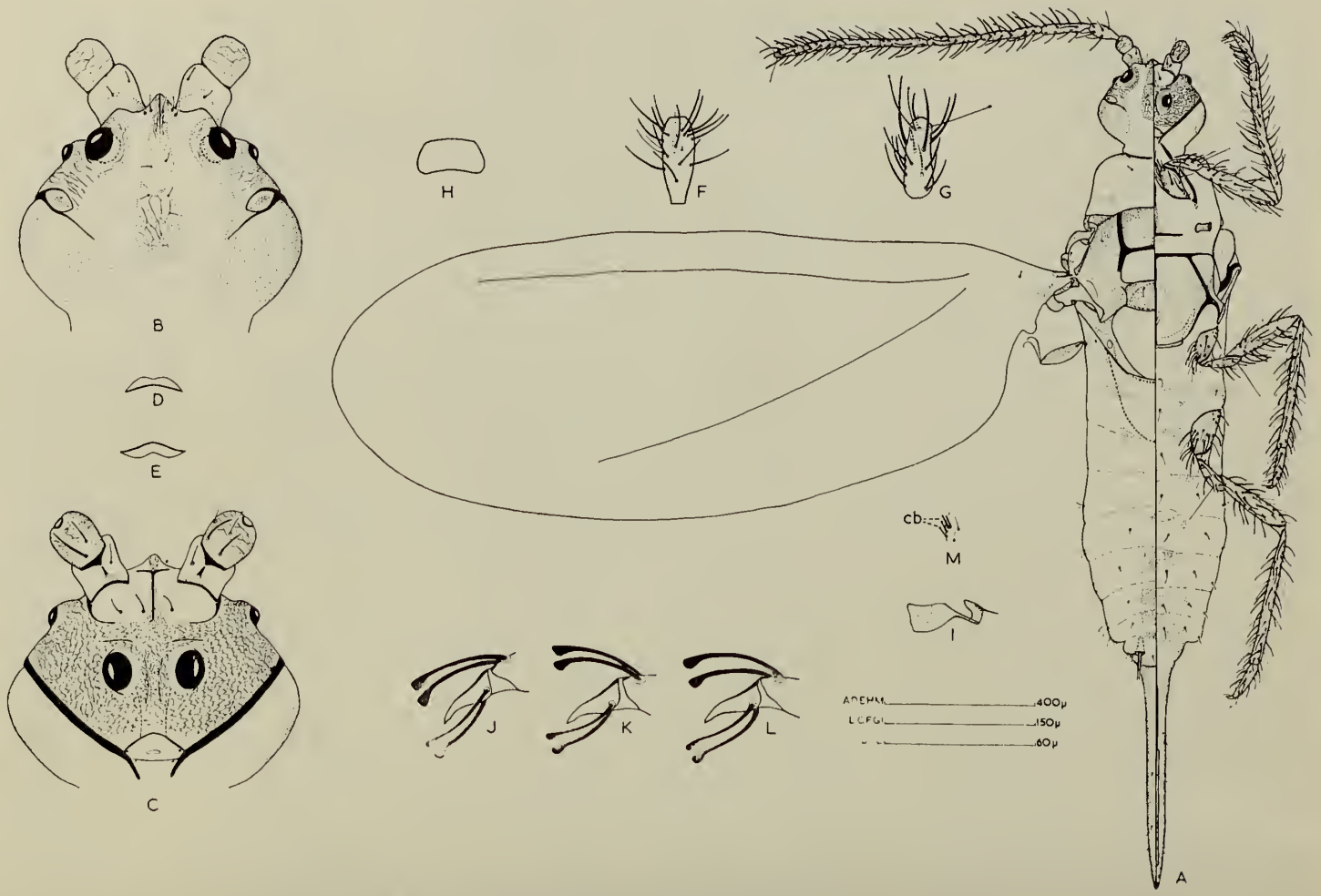


FIG. 4. *Nemolecanium abietis* Borchs., dorsal and ventral view.

(average 2136) μ ; width at mesothorax 415–480 (average 445) μ. Wing expanse 3870–4190 (average 4072) μ.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated, with the antero-dorsal bulge not pronounced ; length from apex to pronotal ridge 251–293 (average 269) μ, width across genae 251–289 (average 274) μ. *Median crest* sclerotized, with a small area near posterior margin more heavily sclerotized ; weakly polygonally reticulated ; with 8–12 (average 10) hair-like *dorsal head setae*, of which 3–5 are situated posterior and 4–8 anterior to the level of the dorsal eyes. *Midcranial ridge* dorsally represented by a weak ridge which usually extends posteriorly to the posterior level of the eyes ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, with surrounding area showing weak polygonal reticulation posteriorly. *Genae* large, sclerotized, not reticulated, without setae. *Eyes* : three pairs ; dorsal and ventral pairs subequal, lateral pair smaller ; corneae of dorsal eyes 22–30 (average 27) μ in diameter and 2·3–3·8 (average 2·9) times as much apart ; those of the ventral eyes 21–30 (average 26) μ in diameter and 1·1–2·2 (average 1·5) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized except between the ventral eyes, where the cuticle is produced into a keel ; polygonally reticulated throughout. *Preocular ridge* long, ventrally extending half-way or more of the distance between the articular process and the midcranial ridge. *Postocular ridge* very weak dorsally, well developed latero-ventrally, and tapering but well defined posteromedially ; below ocellus the ridge usually splits up, with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 2–4 h.s., situated immediately anterior to ocular sclerite, on each side of midcranial ridge. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* medium-sized ; apex bifurcate, extending to around the level of posterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 927–1087 (average 1025) μ long, i.e. shorter than half body length (ratio 1 : 2·02–2·13, average 2·09), slightly longer than posterior leg (ratio 1 : 1·04–1·14, average 1·07) and longer than penial sheath (ratio 1 : 1·55–1·71, average 1·64). *Scape* 53–68 (average 60) μ long and 46–55 (average 51) μ wide, with 3–4 (average 3·2) h.s., area of sclerotization reduced ventrally. *Pedicel* with distinct, polygonal, dorsal reticulation ; 55–68 (average 59) μ long and 42–51 (average 47) μ wide ; with 0–3 (average 2·1) f.s., 1–3 (average 2·5) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 2·5–3·0 (average 2·7) times longer than wide (80–95, average 90 μ long and 30–36, average 34 μ wide) ; with 2–6 (average 4) h.s. and 12–22 (average 15) f.s., the latter of medium length, 1·3–1·8 (average 1·5) times longer than width of segment ; with 1 or 2 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 80–95 (average 90), 103–144 (average 124), 133–171 (average 153), 137–178 (average 160), 103–133 (average 124), 87–106 (average 98) and 76–91 (average 84) respectively, all of about the same width, varying from 23 to 30 μ ; with 20–34 (average 24), 27–36 (average 32), 27–44 (average 35), 25–41 (average 30), 21–31 (average 25) and 19–30 (average 23) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX somewhat larger than f.s. *Segment* X : terminal part not constricted ; 68–82 (average 74) μ long and 23–29 (average 26) μ wide ; carrying 8–13 (average 11) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about $\frac{4}{5}$ as long as the segment and the 2 shorter ones about as long as the f.s., though somewhat thicker ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

FIG. 5. *Nemolecanium abietis* Borchs., lateral view.

Thorax : 619–752 (average 699) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* large, without setae. *Medial pronotal setae* absent. *Post-tergites* medium-sized, without wavy striations, and without setae. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, interrupted median ridge and narrow triangular sclerite. *Anteprosternal* and *prosternal setae* absent.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* less than twice as wide as long (average 197 and 113 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; medially with more heavy sclerotization which is ridge-like posteriorly ; not reticulated. *Scutum*. *Median membranous area* transverse, subrectangular ; 70–95 (average 86) μ long and 1·72–2·27 (average 2) times as wide (width 156–190, average 171 μ) ; without setae. *Scutellum* 72–91 (average 80) μ long and 148–190 (average 164) μ wide, the ratio being 1 : 2·0–2·3 (average 2·1) ; not tubular ; usually with 2 h.s. *Postnotum* with anterior margin irregular and partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with moderately deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, becoming appreciably broader ventrally, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 272 μ wide and 230 μ long, i.e. 2·46–3·03 (average 2·70) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; with 0–2 (average 1·4) h.s. on the median ridge. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 1–5 (average 2·5) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with thickening of posterior margin, sometimes desclerotized medially ; *suspensorial sclerites* small, spot-like ; a small additional sclerite usually present anterior to postnotum. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : occasionally one h.s. on each side. *Pleural ridge* well developed, though interrupted near middle ; with a small *wing process*. *Episternum* with anterior margin ridge-like in parts ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 0–2 (average 0·7) h.s. *Metasternal plate* weak and irregular. *Anterior* and *posterior metasternal setae* usually consisting of 2 (range 1–3) medial h.s. each ; occasionally a h.s. occurs lateral to the posterior part of the basisternum.

Wings hyaline; long (1760–1910, average 1856 μ) and of medium width (700–780, average 753 μ), the ratio width to length being 1 : 2·42–2·51 (average 2·46) ; *alar lobe* present ; *alar setae* usually one (range 0–2) h.s. on each wing. *Halteres* well developed, 125–156 (average 142) μ long and 38–46 (average 43) μ wide, each with 1–3 (average 1·8) apically hooked setae which are about 73 μ long.

Legs short and moderately slender, with middle pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 2·20–2·22 (average 2·21). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	76–80	93–118	220–266	344–391	95–103	24–29	857–984
	(79)	(107)	(245)	(367)	(98)	(26)	(922)
II	76–87	95–110	194–251	308–365	101–114	25–28	798–955
	(83)	(103)	(222)	(345)	(108)	(26)	(886)
III	91–110	106–125	210–247	331–395	114–125	26–30	878–1034
	(100)	(114)	(235)	(371)	(118)	(27)	(964)

f.s. slender and sometimes difficult to separate from h.s.

Coxae with 15–21 (average 19) f.s. on the fore, and 19–27 on the middle and hind coxa, and each with 11–19 h.s. ; fore coxa with 5–6 (average 5·6) coxal bristles, each with a small apical knob ; apical seta about half as long as trochanter. *Trochanters* 26–38 μ wide, with 6 oval sensilla ; with 11–16 (average 12), 7–14 (average 10) and 5–12 (average 8) f.s. on the fore, middle and hind coxa respectively, and with 6–11 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and 2 long setae of which the longest (apical), on the fore trochanter, is 3·0–3·9 (average 3·4) times as long as the width of the trochanter. *Femora* of medium width (42–57 μ), ratio width to length of hind femur being 1 : 4·5–5·2 (average 4·8) ; each with 21–35 f.s. and 12–18 h.s. *Tibiae* 24–30 μ wide, ratio width to length of hind tibia being 1 : 12·3–14·6 (average 13·5) ; each with 69–85 setae of which 20–34 are h.s. and 44–59 f.s., the latter about 1½–1¾ times as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 23–30 μ wide, hind tarsus 3·9–5·0 (average 4·5) times longer than wide ; each with 12–18 f.s. and 11–19 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; anterior *ungual digitule* with larger apical knob than posterior one, digitules about as long as claw.

Abdomen 490–650 (average 570) μ long and 360–430 (average 390) μ wide.

Segments I–VII : *tergites* and *sternites* present on all segments ; tergites on segments II, III and sometimes IV represented by a small sclerite on each side on anterior margin, and on IV–VII by a transverse plate ; sternites represented by a weak transverse plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : h.s. only, segments I–III occasionally with one, and segments IV–VII usually with one seta on each side. *Pleural setae* absent on segments I and II and on III–VI represented by h.s. only, which usually include 2 (range 1–3) *dorsopleural setae* and 1 *ventropleural seta* on each segment. Segment VII with 4–6 (average 4·4) h.s. *Ventral setae* : h.s. only, usually one on each side on II and 4 on each of segments III–VII.

Segment VIII with a weak tergite and transverse sternite, caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is about twice as long as section within pouch. No IX tergite observed. *Ante-anal setae* : 2 long, and occasionally one small h.s. Posterior margin with 3 h.s. on each side.

Genital segment. *Penial sheath* long, about ¾ total body length (ratio 1 : 3·3–3·5, average 3·4), 581–695 (average 628) μ long and 46–53 (average 49) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about ⅔ that of aedeagus, the rod extending anteriorly from base of aedeagus for about $\frac{9}{10}$ of the distance to apex of basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 28–40 (average 32) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (258–315, average 293 μ), penial sheath longer and basisternum shorter, the ratios being 1 : 2·0–2·3 (average 2·1) and 1 : 0·74–0·82 (average 0·78) respectively.

Material examined : 10 specimens, collected by N. S. Borchsenius on *Abies* sp. in the Nikitskii Botanical Gardens, Crimea, USSR on 25.v.54.

PHYSOKERMES

Physokermes piceae (Schrank)

(Text-figs. 6 and 7)

A medium-sized, robust species with comparatively short antennae and legs ; with many setae on the appendages, but few on the body itself. When mounted, total body length 1550–2140 (average 1803) μ ; width at mesothorax 380–500 (average 429) μ. Wing expanse 2950–3200 (average 3063) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced ; length from apex to pronotal ridge 217–270 (average 242) μ, width across genae 171–224 (average 195) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 5–8 (average 6·5) hair-like *dorsal head setae*, arranged in a group of 1–4 (average 2·8) on the anterior margin of the head and a group of 3–4 (average 3·8) more posteriorly. *Midcranial ridge* dorsally represented by a short, weak ridge between the eyes ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area with weak polygonal reticulation posteriorly. *Genae* large, sclerotized, not distinctly reticulated, without setae. *Eyes* : two pairs ; subequal ; corneae of dorsal eyes 20–30 (average 26) μ in diameter and 3·1–4·6 (average 3·9) times as much apart ; those of the ventral eyes with cornea 21–30 (average 26) μ in diameter and 1·0–1·5 (average 1·2) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* with ventral part reaching or almost reaching midcranial ridge. *Postocular ridge* weak and tapering dorsally, well developed lateroventrally, but weak posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent, *ventral head setae* consisting of 4–8 (average 5·3) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge. *Preoral ridge* weak, sometimes interrupted. *Tendon-like apodeme* long. *Cranial apophysis* short ; apex bifurcate, not reaching level of posterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* apparently absent.

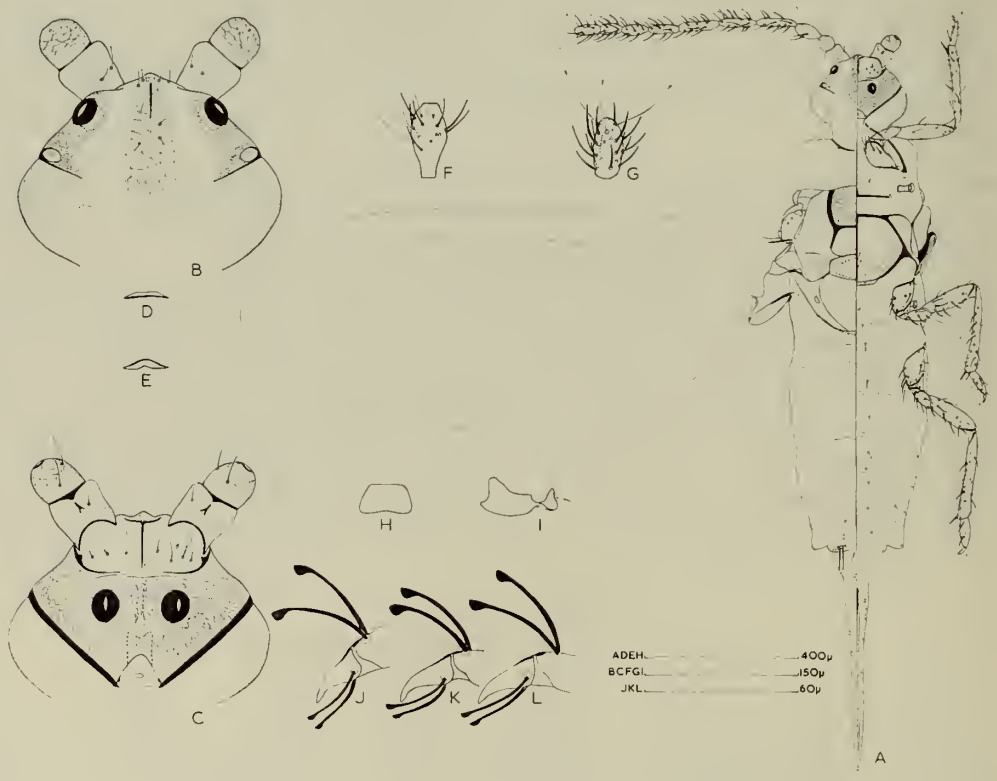


Fig. 6. *Physokermes piceae* (Schr.), dorsal and ventral view.

Antennae 10-segmented, filiform ; 604–1011 (average 770) μ long, i.e. shorter than half body length (ratio 1 : 2·12–2·63, average 2·37), about as long as posterior leg (ratio 1 : 0·91–1·11, average 0·99) and longer than penial sheath (ratio 1 : 1·32–1·69, average 1·47). *Scape* 46–72 (average 59) μ long and 42–61 (average 51) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal dorsal reticulation ; 38–57 (average 46) μ long and 42–53 (average 46) μ wide ; with 2 h.s. and a sensillum placodeum. *Segment* III bulging in middle, 1·8–2·6 (average 2·1) times longer than wide (61–91, average 73 μ long and 30–42, average 35 μ wide) ; with 1–3 (average 2·1) h.s. and 7–19 (average 11) f.s., the latter of medium length, 0·9–1·3 (average 1·1) times as long as width of segment ; with 1–6 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 80–160 (average 114), 68–137 (average 98), 76–137 (average 101), 65–114 (average 86), 57–95 (average 74) and 46–84 (average 61) respectively, widths varying from 25 to 34 μ, with distal segments wider than proximal ones ; with 12–37 (average 25), 14–31 (average 23), 21–30 (average 25), 17–27 (average 24), 15–23 (average 19) and 14–19 (average 17) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX slightly thicker than f.s. *Segment* X : terminal part not constricted ; 46–68 (average 58) μ long and 27–31 (average 30) μ wide ; carrying 7–11 (average 9) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about ⅔ as long as the segment and the 2 shorter ones not markedly different from the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 494–673 (average 565) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* large, without setae. *Medial setae* absent. *Post-tergites* medium-sized, without striations and without setae. *Pleural structures* typical of the family. *Sternum* with transverse ridge strong, median ridge reduced to a basal stalk, and a triangular sclerite. *Anteprosternal setae* absent ; occasionally a hair-like *prosternal seta* present.

Mesothorax. *Mesoprephragma* with no emargination. *Prescutum* about twice as wide as long (average 163 and 88 μ respectively) ; anterior margin slightly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; polygonally reticulated ; slightly more heavily sclerotized medially. *Scutum*. *Median membranous area* subrectangular ; 68–91 (average 82) μ long and 1·48–2·30 (average 1·79) times as wide, (width 122–179, average 146 μ) ; without setae. *Scutellum* 59–103 (average 78) μ long and 133–194 (average 151) μ wide, ratio being 1 : 1·8–2·4 (average 2) ; not tubular ; without setae. *Postnotum* with anterior margin irregular and partly overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with shallow emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below the membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 251 μ wide and 168 μ long, i.e. 1·7–2·4 (average 2·1) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; with 1–2 (average 1·8) h.s. on or near median ridge. *Furca* well developed. *Mesothoracic spiracle* with well developed peri-

Fig. 7. *Physokermes piceae* (Schr.), lateral view.

treme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 2–7 (average 4·2) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with posterior margin usually strong and well developed throughout; *suspensorial sclerites* small, spot-like. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* absent. *Pleural ridge* well developed, though interrupted near middle ; with a small *wing process*. *Episternum* with anterior margin not ridge-like ; vestigial *precoxal ridge* present ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : occasionally one h.s. present. *Metasternal plate* weak and irregular. *Anterior* and *posterior metasternal setae* : 1–5 (average 2·4) and 0–3 (average 1·8) h.s. respectively, arranged medially.

Wings hyaline; medium-sized : 1300–1450 (average 1367) μ long and 470–580 (average 542) μ wide, ratio width to length being 1 : 2·44–2·77 (average 2·53) ; *alar lobe* present ; *alar setae* absent. *Halteres* well developed, 103–137 (average 117) μ long and 27–43 (average 35) μ wide ; each usually with 2 (range 1–3) apically hooked setae, which are about 62 μ long.

Legs short and moderately slender, with middle pair usually shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 2·30–2·47 (average 2·41). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57–76	78–110	165–217	209–300	63–80	23–27	600–805
	(66)	(94)	(187)	(248)	(71)	(25)	(691)
II	65–91	78–110	154–205	209–289	74–95	26–28	608–815
	(73)	(88)	(171)	(242)	(82)	(27)	(684)
III	72–95	82–110	163–220	220–314	76–110	27–30	667–866
	(80)	(94)	(187)	(262)	(90)	(28)	(741)

F.s. slender and sometimes difficult to separate from h.s.

Coxae with 1–6 (average 3·4) f.s. on the fore and 5–14 on the middle and hind coxa, and each with 9–16 h.s. ; fore coxa without coxal bristles ; apical seta about ¾ as long as trochanter. *Trochanters* 27–38 μ wide ; with 6 oval sensilla, 1–8 f.s. and 5–6 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae, of which the longest (apical), on the fore trochanter, is 2·1–2·6 (average 2·4) times as long as width of trochanter. *Femora* of medium width (42–49 μ), ratio width to length of hind femur being 1 : 3·6–4·4 (average 3·8) ; with 1–11 (average 5·3), 3–14 (average 7·8) and 4–17 (average 9·8) f.s. on the fore, middle and hind femur respectively and with 6–19 h.s. on each. *Tibiae* 23–30 μ wide, ratio width to length of hind tibia being 1 : 8·3–10·0 (average 9·2) ; each with 24–49 setae of which 15–26 are h.s. and 7–28 f.s., the latter about as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 23–30 μ wide, hind tarsus 2·9–3·9 (average 3·3) times longer than wide ; each with 1–6 f.s. and 6–10 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 380–760 (average 499) μ long and 320–440 (average 376) μ wide.

Segments I–VII : *tergites* and *sternites* present on all segments ; tergites on segments II–III represented by a small sclerite on each side on the anterior margin, and on segments IV–VII represented by a small sclerite on each side on the anterior margin, and on the IV–VII segments by weak plates ; sternites consisting of weak transverse plates. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : f.s. absent ; h.s. usually absent on segments I–VI, but segment VII with one on each side. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : occasionally one on II, 0–2 (average 1·1) on III and usually 2 on each of segments IV–VI, and *ventropleural setae* : sometimes one on II and III, and one on each of segments IV–VI. Segment VII with 3–4 (average 3·9) h.s. *Ventral setae* : h.s. only, usually 2 medially on all segments, but occasionally only one or up to 4 present.

Segment VIII with transverse tergite and a very large transverse sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is about twice as long as section within pouch ; with 3 h.s. on each side near pouch. *Ante-anal area* expanded, with 1–2 (average 1·8) strong h.s. and sometimes with indications of a small IX tergite.

Genital segment. Penial sheath long, about $\frac{2}{3}$ total body length (ratio 1 : 3·2–3·6, average 3·4), 456–597 (average 530) μ long and 43–53 (average 48) μ wide ; the basal area anterior to the aedeagus about twice as wide as rest of sheath ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about $\frac{1}{3}$ – $\frac{1}{4}$ that of aedeagus, the rod extending anteriorly from base of aedeagus for about $\frac{3}{4}$ of the distance to the apex of basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 23–36 (average 29) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (285–380, average 342 μ), penial sheath longer and basisternum shorter, ratios being 1 : 1·49–1·61 (average 1·55) and 1 : 0·43–0·54 (average 0·49) respectively.

Material examined : 10 specimens, collected by J. Řeháček on *Picea* sp. on 12.iv.53 in Plešivec, Czechoslovakia ; remounted from Swann's mountant.

P. piceae (Schr.) differs from *P. insignicola* (Craw) in having only 2 pairs of simple eyes. Moulton (1907) found 4 pairs in *P. insignicola*. *P. piceae* is also described as having 2 pairs of eyes by Jancke (1955).

RHODOCOCCUS

Rhodococcus spiraeae (Borchsenius)

(Text-figs. 8 and 9)

A short, robust species with comparatively long antennae and moderately long legs ; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1500–1600 (average 1557) μ ; width at mesothorax 400–420 (average 411) μ. Wing expanse 2860–3000 (average 2940) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with the the anterodorsal bulge not pronounced ; length from apex to pronotal ridge 198–213 (average 206) μ, width across genae 194–232 (average 217) μ. *Median crest* broad posteriorly, weakly sclerotized and reticulated, with 3–6 (average 4·7) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing weak polygonal reticulation posteriorly. *Genae* large, sclerotized, not reticulated, without setae. *Eyes* : four pairs ; dorsal and ventral pairs large, subequal ; lateral pairs smaller, subequal ; corneae of dorsal eyes 19–23 (average 21) μ in diameter and 4·4–5·6 (average 5·0) times as much apart ; those of the ventral eyes 17–23 (average 19) μ in diameter and 1·5–2·2 (average 1·8) times as much apart. *Ocellus* small, situated laterally. *Ocular sclerite* well sclerotized and polygonally reticulated throughout ; dorsally widely separated from median crest. *Preocular ridge* of variable length, ventral part usually extending about half-way from articular process to midcranial ridge. *Postocular ridge* very weak dorsally, sometimes missing posterior to ocellus ; well developed lateroventrally, but weak posteromedially ; below ocellus the ridge splits up, with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 0–4 (average 2·1) h.s., situated on or immediately anterior to margin of the ocular sclerite on each side of midcranial ridge. *Preoral ridge* present. *Tendon-like* apodeme long, with a broad base. *Cranial apophysis* broad, of medium length ; apex truncate with a central lobe, not reaching level of anterior margin of eyes. *Mouth opening* irregular. *Anterior tentorial pits* apparently present anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 980–1017 (average 995) μ long, i.e. longer than half body length (ratio 1 : 1·52–1·61, average 1·57), longer than posterior leg (ratio 1 : 1·14–1·21, average 1·17) and longer than penial sheath (ratio 1 : 2·44–2·63, average 2·53). *Scape* 38–51 (average 45) μ long and 46–49 (average 48) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal dorsal reticulation ; 46–57 (average 54) μ long and 42–48 (average 45) μ wide ; with 3–7 (average 5·3) f.s., 1–2 (average 1·4) h.s. and a sensillum placodeum. *Segment* III club-shaped, 2·4–3·7 times longer than wide (72–95, average 82 μ long and 23–34, average 29 μ wide) ; with 2–4 (average 2·8) f.s. of medium length, 0·9–1·4 (average 1) times as long as width of segment ; with 2–4 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 148–179 (average 162), 152–175 (average 165), 122–171 (average 142), 114–137 (average 125), 80–87 (average 86) and 65–74 (average 68) respectively, all of about the same width, varying from 19 to 27 μ ; with 17–22 (average 20), 19–24 (average 22), 20–33 (average 24), 22–28 (average 25), 15–19 (average 17) and 13–17 (average 15) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX not markedly different from f.s. *Segment* X : terminal part not constricted ; 61–72 (average 67) μ long and 17–23 (average 21) μ wide ; carrying 5–11 (average 8) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about half as long as the segment and the 2 shorter ones rather similar to the f.s. ; with 2 sensilla basonica ventrally, one near apex and the other more proximal.

Thorax 505–559 (average 520) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* absent. *Post-tergites* medium-sized, without striations and without setae. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, median ridge reduced to a basal stalk, and a triangular sclerite. *Anteprosternal* and *prosternal* setae absent.

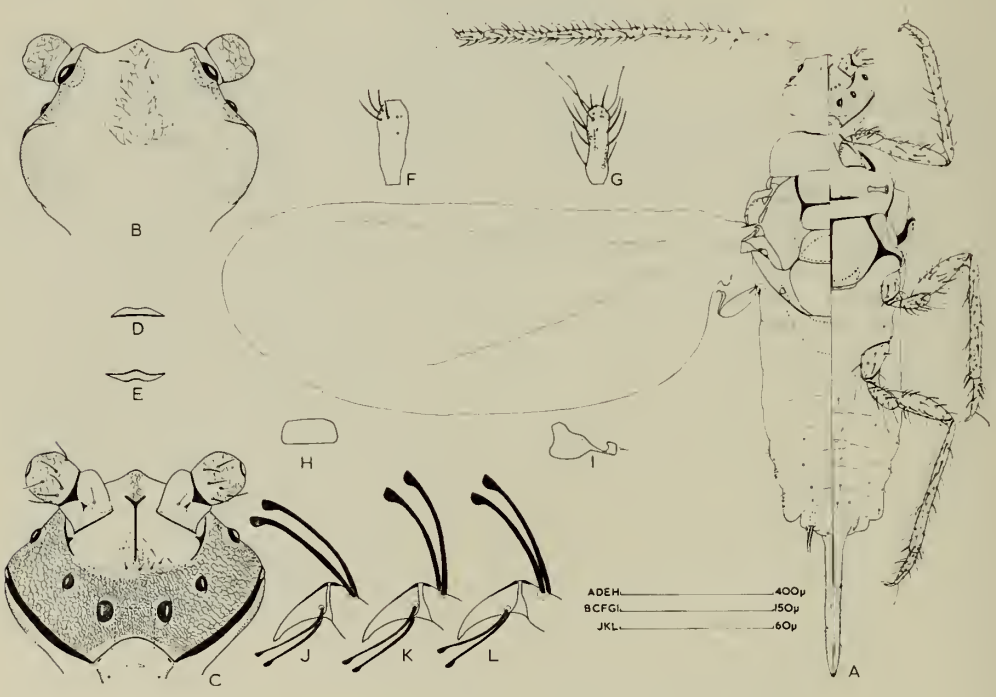


Fig. 8. *Rhodococcus spiraeae* (Borchs.), dorsal and ventral view.

Mesothorax. Mesoprephragma with shallow emargination. *Prescutum* about twice as wide as long (average 156 and 82 μ respectively) ; anterior margin slightly curved; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; sometimes with weak polygonal reticulation. *Scutum*. *Median membranous area* subrectangular ; 49–65 (average 59) μ long and 1·81–2·36 (average 2·01) times as wide (width 106–125, average 117 μ) ; without setae. *Scutellum* large, 76–95 (average 84) μ long and 125–144 (average 135) μ wide, the ratio being 1 : 1·5–1·7 (average 1·6) ; not tubular ; without setae. *Postnotum* with anterior margin irregular and partly overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with moderately deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 237 μ wide and 160 μ long, i.e. 2·4–3·4 (average 2·8) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges*. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular* setae absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 2–5 (average 3·2) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with thickening of posterior margin desclerotized medially ; *suspensorial sclerites* small, spot-like. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* absent. *Pleural ridge* well developed, though interrupted in the middle ; with small *wing process*. *Episternum* with anterior margin ridge-like in parts ; vestigial *precoxal ridge* present ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : occasionally one h.s. *Metasternal plate* weak and irregular. *Anterior* and *posterior metasternal setae* absent.

Wings hyaline ; long (1270–1350, average 1310 μ) and of medium width (480–540, average 512 μ), ratio width to length being 1 : 2·49–2·65 (average 2·57) ; *alar lobe* present ; *alar setae* : 0–3 (average 1·5) h.s. on each wing. *Halteres* well developed, 114–129 (average 121) μ long and 27–42 (average 37) μ wide, each with 2 (rarely 3) apically hooked setae, which are about 69 μ long.

Legs moderately long and slender, with middle pair usually shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·72—1·83 (average 1·78). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65–76	99–110	205–228	308–315	76–95	27–30	798–834
	(68)	(103)	(218)	(312)	(89)	(29)	(819)
II	72–84	95–105	182–200	308–317	91–99	30–34	798–820
	(81)	(101)	(192)	(311)	(97)	(31)	(813)
III	76–87	99–110	186–209	312–352	103–106	30–34	834–882
	(83)	(104)	(200)	(338)	(105)	(32)	(862)

FIG. 9. *Rhodococcus spiraeae* (Borchs.), lateral view.

F.s. slender and sometimes difficult to separate from h.s.

Coxae each with 4–9 f.s. and 10–19 h.s. ; fore coxa without coxal bristles ; apical seta about $\frac{2}{3}$ as long as trochanter. *Trochanters* 29–38 μ wide ; with 6 oval sensilla ; with 5–10 f.s., and 8–10 (average 8·8), 10–14 (average 12) and 12–22 (average 16) h.s. on fore, middle and hind trochanter respectively, the h.s. including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae of which the longest (apical), on the fore trochanter, is 2·3–3·1 (average 2·9) times as long as width of trochanter. *Femora* of medium width (42–51) μ, ratio width to length of hind femur being 1 : 3·8–4·4 (average 4·1) ; each with 6–14 f.s. and 11–25 h.s. *Tibiae* 23–40 μ wide, ratio width to length of hind tibia being 1 : 11·4–14·2 (average 12·6) ; each with 45–68 setae of which 30–60 are h.s. and 8–18 f.s., the latter somewhat longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 21–27 μ wide, hind tarsus 4·3–4·7 (average 4·6) times longer than wide ; each with 4–8 f.s. and 15–26 h.s. ; *tarsal digitules* subequal, long, about $1\frac{1}{2}$ times as long as claw. *Claws* long, hind claw about $1\frac{1}{2}$ times as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 430–500 (average 474) μ long and 300–350 (average 331) μ wide.

Segments I–VII : *tergites* on segments II–III represented by a small sclerite on each side on the anterior margin, and on VI and VII by a weak plate ; *sternites* present on segments II, III and VII, represented by weak plates. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : f.s. absent ; h.s. absent on I and usually on II, but usually one on each side on segments III–VII. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : 0–2 (average 1·0), 2–5 (average 3·7), 4–7 (average 6) and 4–8 (average 5·8) on segments III–VI respectively, and *ventropleural* setae : occasionally one on III and usually one on each of segments IV–VI. Segment VII with 6–15 (average 11) h.s. *Ventral setae* : h.s. only, occasionally one on II, usually 2 medially on III, and 4 on each of segments IV–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is $1\frac{1}{2}$–2 times as long as section within pouch. A small IXth tergite sometimes perceptible. *Ante-anal setae* : 1–2 (average 1·8) long h.s. Posterior margin with 2–3 (average 2·8) h.s. on each side.

Genital segment. Penial sheath long, about $\frac{1}{4}$ total body length (ratio 1 : 3·8–4·1, average 3·9), 376–414 (average 399) μ long and 36–40 (average 38) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about $\frac{2}{3}$ that of aedeagus, the rod extending anteriorly from base of aedeagus for about $\frac{3}{4}$ of the distance to apex of basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 19–23 (average 21) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (167–182, average 173 μ), penial sheath longer and basisternum shorter, the ratios being 1 : 2·25–2·42 (average 2·30) and 1 : 0·83–0·98 (average 0·92) respectively.

Material examined : 9 specimens, collected by G. Matesova on *Spiraea hypersifolia* L. in the ravine Talgar, Zailiiski Alatau, Kazakhstan, USSR, on 14.vi.57.

PALAEOLECANIUM

Palaeolecanium bituberculatum (Targ.)

(Text-figs. 10 and 11)

Living specimens coral-red in colour, with the sclerotized areas brown and the appendages light yellow, wings with a reddish tinge between anterior margin and first wing vein ; short, slender, with comparatively long antennae and short legs which carry many setae. When mounted, total body length 1380–1460 (average 1419) μ ; width at mesothorax 290–320 (average 310) μ. Wing expanse 2470–2660 (average 2566) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced ; length from apex to pronotal ridge 205–232 (average

220) μ, width across genae 217–241 (average 233) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 6–9 (average 7·4) hair-like *dorsal head setae*, arranged in a group of one or two near the anterior margin of the head and a group of 5–8 (average 6·2) more posteriorly. *Midcranial ridge* dorsally represented by a short, weak ridge near anterior margin; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, surrounding area with weak, polygonal reticulation posteriorly. *Genae* large, sclerotized, not distinctly reticulated, without setae. *Eyes* : two pairs ; subequal ; corneae of dorsal eyes 21–25 (average 22) μ in diameter and 3·4–4·2 (average 3·9) times as much apart ; those of the ventral eyes 22–27 (average 24) μ in diameter and 1·2–1·8 (average 1·6) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* with ventral part almost reaching midcranial ridge. *Postocular ridge* weak and tapering dorsally, well developed lateroventrally, but weak posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 4–7 (average 5·6) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge. *Preoral* ridge present. *Tendon-like apodeme* short. *Cranial apophysis* of medium length ; apex bifurcate with a central lobe, extending to around the level of the posterior margin of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* apparently absent.

Antennae 10-segmented, filiform ; 705–883 (average 819) μ long, i.e. longer than half body length (ratio 1 : 1·63–1·96, average 1·76), longer than posterior leg (ratio 1 : 1·15–1·22, average 1·19) and longer than penial sheath (ratio 1 : 2·83–3·26, average 3·09). *Scape* 46–57 (average 51) μ long and 40–46 (average 42) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 42–51 (average 47) μ long and 38–42 (average 40) μ wide ; with 1–7 (average 4·3) f.s., 2–5 (average 3·5) f.s. and a sensillum placodeum. *Segment* III club-shaped, 2·7–3·6 (average 3·2) times longer than wide (76–87, average 81 μ long and 21–30, average 26 μ wide),

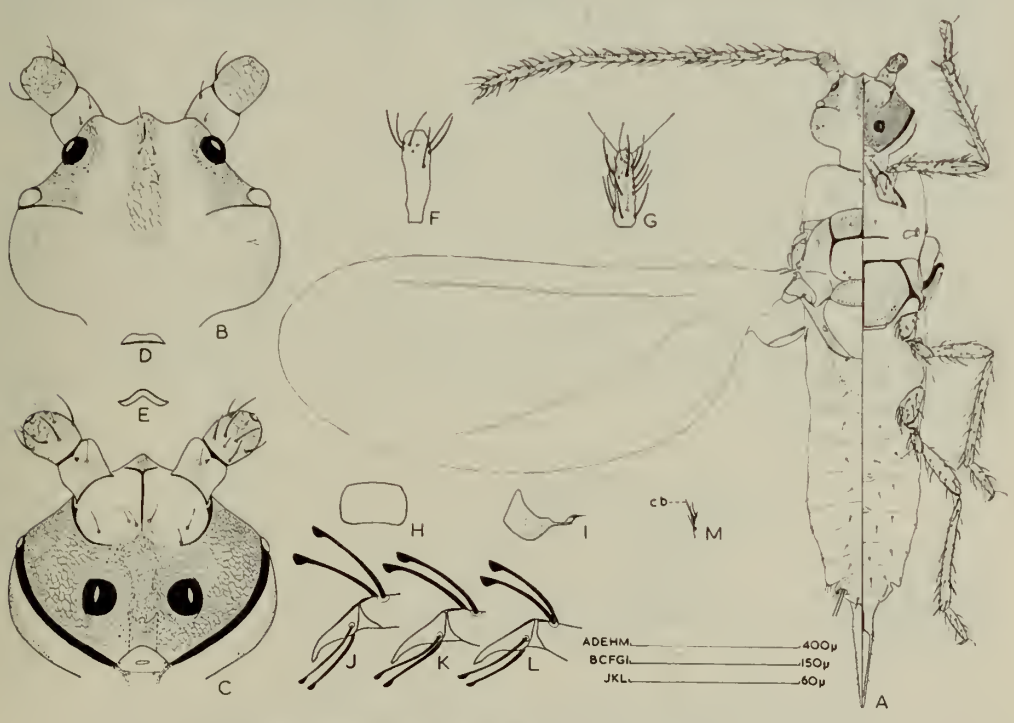


FIG. 10. *Palaeolecanium bituberculatum* (Targ.), dorsal and ventral view.

with 2–8 (average 4·8) f.s. of medium length, 1·3–1·7 (average 1·5) times as long as width of segment ; with 1–2 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 87–122 (average 109), 195–125 (average 118), 91–114 (average 101), 80–110 (average 100), 65–91 (average 76) and 57–76 (average 68) respectively, width varying form 17 to 23 μ, with distal segments wider than proximal ones ; with 12–19 (average 15), 15–22 (average 18), 12–19 (average 15), 15–20 (average 16), 11–19 (average 14) and 11–14 (average 13) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII and IX not markedly different from f.s., sometimes somewhat thicker. *Segment* X : terminal part not constricted ; 53–78 (average 70) μ long and 19–23 (average 21) μ wide ; carrying 4–11 (average 8·6) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about half as long as the segment and the 2 shorter ones equal to or somewhat shorter than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 445–517 (average 497) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* medium-sized, without setae. *Medial pronotal setae* : 2 small h.s., situated close together on the median line. *Post-tergites* very small and weakly sclerotized, without striations and without setae. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, median ridge reduced to a basal stalk or sometimes absent, and a triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* : occasionally one h.s. present.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 145 and 74 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; weakly irregularly reticulated ; with a median ridge extending for some distance anteriorly from the prescutal suture. *Scutum*. *Median membranous area* subrectangular ; 76–91 (average 82) μ long and 1·47–1·75 (average 1·57) times as wide (width 118–137, average 128) ; with 1–4 (average 2·7) h.s. *Scutellum* 57–68 (average 63) μ long and 118–133 (average 127) μ wide, ratio being 1 : 1·9–2·2 (average 2) ; not tubular ; occasionally with one or two h.s. *Postnotum* with anterior margin irregular and partly overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* anteriorly bounded by an extension from marginal ridge. *Basisternum* large, about 199 μ wide and 148 μ long, i.e. 1·7–2·1 (average 1·8) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 4–7 (average 5) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

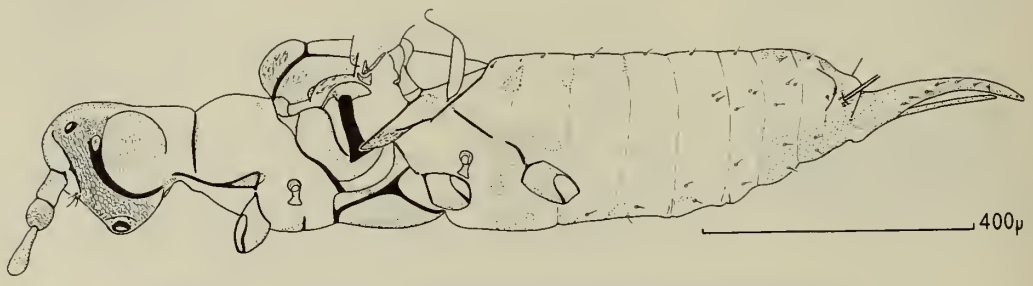


Fig. 11. *Palaeolecanium bituberculatum* (Targ.), lateral view.

Metathorax. *Metanotum* with anterior margin desclerotized medially ; *suspensorial sclerites* small, spot-like. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : one h.s. on each side. *Pleural ridge* well developed, though interrupted near the middle ; with a small *wing process*. *Episternum* with anterior margin not ridge-like ; vestigial *precoxal ridge* sometimes present ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : occasionally one h.s. *Metasternal plate* weak and irregular. *Anterior* and *posterior metasternal setae* absent.

Wings hyaline ; long (1110–1190, average 1155 μ) and of medium width (450–510, average 474 μ), ratio width to length being 1 : 2·33–2·58 (average 2·44) ; *alar lobe* present ; *alar setae* absent. *Halteres* well developed, 95–114 (average 103) μ long and 20–30 (average 25) μ wide, each with one apically hooked seta, which is about 50 μ long.

Legs short and slender, with the fore pair longest and the middle pair shortest ; ratio length of hind leg to body length is 1 : 1·94–2·06 (average 1·99). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57–61	76–84	171–186	255–285	89–99	25–27	695–735
	(58)	(80)	(183)	(274)	(95)	(26)	(715)
II	61–65	68–72	163–175	247–277	87–95	23–25	654–701
	(63)	(70)	(169)	(261)	(90)	(24)	(678)
III	57–68	67–72	163–175	257–289	87–99	24–27	669–722
	(65)	(69)	(170)	(273)	(94)	(26)	(697)

Coxae with 7–14 (average 10) f.s. on the fore and 14–19 on the middle and hind coxa, and each with 7–15 h.s. ; fore coxa with 1–2 (average 1·4) pointed coxal bristles, about as long as segment; apical seta about half as long as trochanter. *Trochanters* 24–29 μ wide ; with 6 oval sensilla, 4–8 f.s. and 6–8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae of which the longest (apical), on the fore trochanter, is 1·8–2·2 (average 2) times as long as width of trochanter. *Femora* of medium width (34–40 μ), ratio width to length of hind femur being 1 : 4·4–5·0 (4·7) ; each with 8–14 f.s. and 12–19 h.s. *Tibiae* 19–23 μ wide, ratio width to length of hind tibia being 1 : 12·3–14·6 (average 13·1) ; each with 35–51 setae of which 19–27 are h.s. and 15–30 f.s., latter somewhat longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 19–23 μ wide, hind tarsus 4·2–4·9 (average 4·4) times longer than wide ; each with 4–8 f.s. and 11–17 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 420–480 (average 461) μ long and 240–300 (average 263) μ wide.

Segments I–VII : *tergites* on segments II–III represented by small sclerites on the anterior margin—one on each side and one medially on II, one on each side on III, and on segments VI–VII by weak transverse plates ; *sternites* present on all segments, represented by a weak transverse plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : h.s. only, usually one on each side on all segments. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : occasionally one on III and usually 2 on each of segments IV–VI, and *ventropleural setae* : occasionally one on each of segments IV–V and usually one on VI. Segment VII with 3–5 (average 3·8) h.s. *Ventral setae* : h.s. only, 2 medially on II, and 1–3 (average 2·4), 2–4 (average 3), 3–4 (average 3·5), 3–5 (average 3·9) and 3–4 (average 3·8) on segments III–VII respectively.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2–2½ times as long as section within pouch. No IX tergite observed. *Ante-anal setae* : 2 long h.s. Posterior margin with 2–4 (average 2·6) h.s. on each side.

Genital segment. *Penial sheath* of medium length, about ⅓ total body length (ratio 1 : 5·09–5·65, average 5·39), 247–277 (average 266) μ long and 46–61 (average 52) μ wide ; lateral sclerotizations not joined anterior to anus; length of *basal rod* ⅓–⅔ that of aedeagus, the rod

extending anteriorly from base of aedeagus to the apex of basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 17–22 (average 19) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* broad at its base and tapering towards tip ; long (129–148, average 141 μ), penial sheath longer and basisternum as long or longer, the ratios being 1 : 1·8–2·0 (average 1·9) and 1 : 0·99–1·14 (average 1·04) respectively.

Material examined : 10 specimens, bred from material collected by myself on *Crataegus* sp. (hawthorn) on Putney Heath, London ; males emerged in the laboratory between the 19th and 22nd June, 1962. Four specimens, collected by J. Řeháček on *Crataegus oxyacantha* L. in Novy Bydžov, Czechoslovakia on 18.vi.52 (remounted from Swann's mountant) agreed well with the above description, but differed in the following respects : (i) 2 specimens were longer, measuring 1490 μ each, (ii) the darker median sclerotization on the prescutum was less well developed and not ridge-like in appearance and (iii) the reticulation on the prescutum was more distinct.

PHYLLOSTROMA

Phyllostroma myrtilli (Kaltenbach)

(Text-figs. 12 and 13)

A small, slender species with comparatively long antennae and short legs ; with many setae on the appendages, but few on the body itself. When mounted, total body length 1460–1620 (average 1553) μ ; width at mesothorax 370–410 (average 387) μ. Wing expanse 2870–3010 (average 2940) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced ; length to pronotal ridge 209–247 (average 226) μ, width across genae 255–270 (average 262) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 6–10 (average 7·4) hair-like *dorsal head setae*, arranged in a group of 3–5 near anterior margin of head and a group of 2–5 more posteriorly. *Midcranial ridge* dorsally absent; ventrally narrow but well defined, surrounding area weakly sclerotized and distinctly polygonally reticulated. *Genae* large, sclerotized, not reticulated, without setae. *Eyes* four pairs ; dorsal and ventral pairs large, subequal ; lateral pairs smaller, subequal ; corneae of dorsal eyes 23–27 (average 24) μ in diameter and 3·4–4·5 (average 4·1) times as much apart ; those of the ventral eyes 25–30 (average 28) μ in diameter and 1·3–1·7 (average 1·5) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* short, not extending far below articular process. *Postocular ridge* weak and tapering dorsally, but well developed lateroventrally and posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 8–14 (average 10) h.s., situated around posterior part of the midcranial ridge. *Preoral ridge* present. *Tendon-like apodeme* short. *Cranial apophysis* of medium length ; apex bifurcate with central lobe, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* present, situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 910–1053 (average 986) μ long, i.e. longer than half body length (ratio 1 : 1·43–1·65, average 1·57), longer than posterior leg (ratio 1 : 1·23–1·33, average 1·27) and longer than penial sheath (ratio 1 : 3·15–3·47, average 3·36). *Scape* long (length 65–68, average 66 μ) and 42–48 (average 45) μ wide, with 1–3 (average 2) h.s. *Pedicel* not reticulated, but with one or two wavy lines ; 61–68 (average 65) μ long and 42–46 (average 44) μ wide ; with 5–10 (average 7·4) f.s., 3–5 (average 3·7) h.s., and a sensillum placodeum. *Segment* III club-shaped, 2·5–3·1 (average 2·8) times longer than wide (76–84, average 79 μ long

and 42–46, average 44 μ wide), with 4–8 (average 6) f.s. of medium width, 1·2–1·5 (average 1·3) times as long as width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 118–152 (average 138), 122–148 (average 137), 118–141 (average 131), 99–133 (average 111), 91–106 (average 97) and 80–99 (average 86) respectively, widths varying from 21–27 μ with distal segments wider than proximal ones ; with 15–22 (average 18), 15–23 (average 20), 18–28 (average 23), 16–25 (average 20), 14–18 (average 16) and 15–21 (average 18) f.s. respectively, and occasionally with one or two h.s. on segments IV–VI ; *antennal bristles* on segments VIII–IX not markedly different from f.s. *Segment* X : terminal part not constricted ; 67–86 (average 76) μ long and 20–23 (average 22) μ wide ; carrying 5–8 (average 6·4) f.s., 3 capitate *subapical setae*, and 5 *antennal bristles* of which the 3 longest ones are about half as long as the segment and the 2 shorter ones rather similar to the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 460–532 (average 503) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : usually 2 h.s. *Post-tergites* small and irregular, without striations and without setae. *Pleural structures* typical of family. *Sternum* with strong transverse and median ridges, well sclerotized triangular sclerite and rather distinct sternal apophyses. *Anteprosternal* setae absent ; *prosternal setae* : sometimes one h.s. on each side.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 160 and 83 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially but not reticulated. *Scutum*. *Median membranous area* subrectangular ;

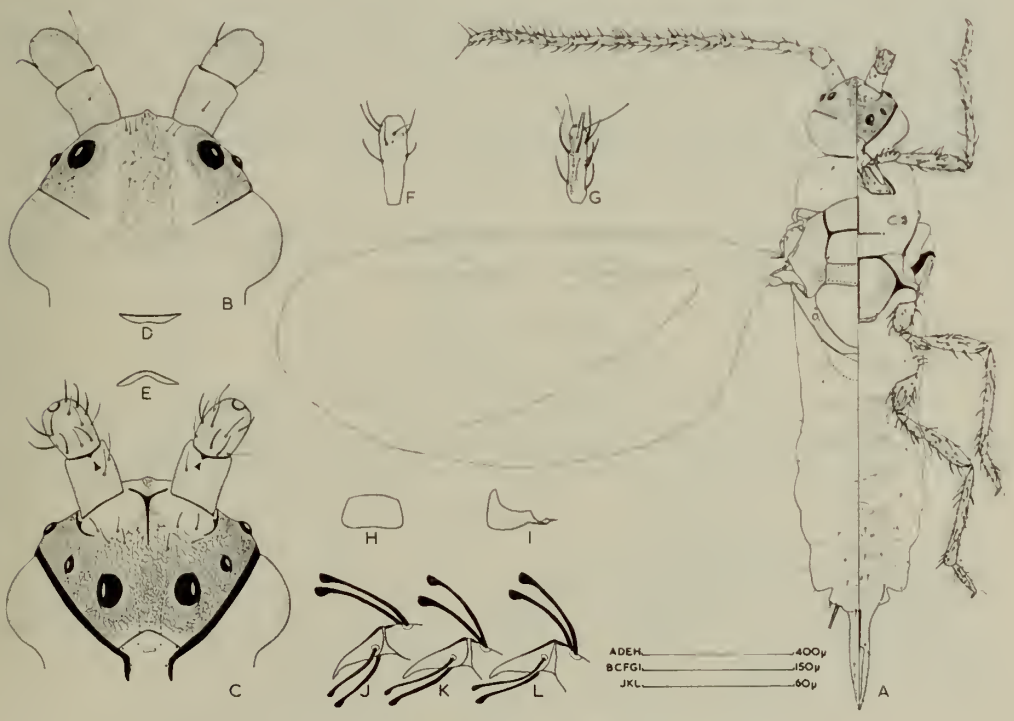


FIG. 12. *Phyllostroma myrtilli* (Kalt.), dorsal and ventral view.

68–91 (average 78) μ long and 1·79–2·17 (average 1·94) times as wide (width 137–163, average 150 μ) ; with 1–2 (average 1·7) h.s. *Scutellum* 57–68 (average 64) μ long and 160–171 (average 166) μ wide, the ratio being 1 : 1·8–2·2 (average 1·9) ; not tubular ; without setae. *Postnotum* with anterior margin irregular, not overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* small, with moderately deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 210 μ wide and 151 μ long, i.e. 1·7–2·2 (average 1·9) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 0–4 (average 1·9) h.s. *Third axillary wing sclerite* with a small ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with anterior margin desclerotized medially ; *suspensorial sclerites* absent ; a small, additional sclerite sometimes present anterior to postnotum. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : occasionally one h.s. on each side. *Pleural ridge* reduced, extending only for a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 2–6 (average 4) f.s. and 0–1 (average 0·7) h.s. *Metasternum* represented by a weak, transverse plate. *Anterior* and *posterior metasternal setae* absent.

Wings hyaline ; long (length 1260–1330, average 1295 μ) and broad (width 570–600, average 585 μ), ratio width to length being 1 : 2·19–2·24 (average 2·22) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and moderately slender, with the fore pair usually longest and the middle pair shortest ; ratio length of hind leg to body length is 1 : 1·89–2·05 (average 1·99). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65–80	91–99	198–213	285–304	99–122	23–27	785–828
	(74)	(95)	(207)	(295)	(107)	(26)	(804)
II	68–80	87–93	182–194	281–296	99–106	23–29	762–785
	(75)	(91)	(189)	(289)	(102)	(26)	(771)
III	76–91	91–99	179–190	289–300	99–110	21–29	771–800
	(83)	(95)	(184)	(296)	(106)	(26)	(788)

Coxae with 11–16 (average 14) f.s. on the fore and 16–22 on the middle and hind coxa, and each with 9–12 h.s. ; fore coxa without coxal bristles ; apical seta about ½ as long as trochanter. *Trochanters* 30–34 μ wide ; with 6 oval sensilla, 6–14 f.s. and 5–8 h.s., the latter including 2

FIG. 13. *Phyllostroma myrtilli* (Kalt.), lateral view.

minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·3–2·1 (average 1·8) times as long as width of trochanter. *Femora* of medium width (38–46 μ), ratio width to length of hind femur being 1 : 3·9–4·6 (average 4·2) ; each with 10–19 f.s., and with 15–24 (average 19) h.s. on the fore and 11–16 on the middle and hind femur. *Tibiae* 23–27 μ wide, ratio width to length of hind tibia being 1 : 11·3–12·7 (average 12) ; each with 36–56 setae, of which 17–32 are h.s. and 14–28 f.s., the latter somewhat longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 22–27 μ wide, hind tarsus 4·0–4·8 (average 4·5) times longer than wide ; each with 2–7 f.s. and 10–19 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with very small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 490–580 (average 531) μ long and 320–380 (average 346) μ wide.

Segments I–VII : *tergites* and *sternites* present on all segments ; tergites represented by a transverse sclerite on or near anterior margin (sometimes interrupted medially) ; sternites represented by a weak transverse plate in middle of each segment. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : h.s. only, usually one on each side on segments I and V–VII. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : usually 2 on each of segments III–VI, and *ventropleural setae* : occasionally one on each of III–V, and usually on segment VI. Segment VII with 1–6 (average 3) h.s. *Ventral setae* : h.s. only, usually none on II, one on each side on III and IV, and 4 on each of segments V–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is about twice as long as section within pouch. No IXth tergite observed. *Ante-anal setae* usually 2 (range 1–4) h.s. Posterior margin with 3–4 (average 3·5) h.s. on each side.

Genital segment. Penial sheath of medium length, about ½ total body length (ratio 1 : 4·97–5·57, average 5·27), 285–304 (average 294) μ long and 46–49 (average 48) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about ⅔ that of aedeagus, the rod extending anteriorly from base of aedeagus to the apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 11–19 (average 15) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* of medium length (118–137, average 127 μ), penial sheath and basisternum longer, the ratios being 1 : 2·2–2·6 (average 2·3) and 1 : 1·11–1·29 (average 1·19) respectively.

Material examined : 8 specimens, collected by J. Řeháček on *Vaccinium myrtillus* L. in Czechoslovakia on 6.vii.1953 (remounted from Swann's mountant).

FILIPPIA

Filippia viburni (Signoret)

(Text-figs. 14 and 15)

A moderately long and robust species, with comparatively long antennae and moderately long legs ; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1940–2080 (average 2004) μ ; width at mesothorax 440–490 (average 469) μ. Wing expanse 3630–3940 (average 3798) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced ; length from apex to pronotal ridge 262–285 (average 277) μ, width across genae 289–312 (average 297) μ. *Median crest* sclerotized and striated posteriorly, but usually without polygonal reticulation ; with 7–12 (average 9·3) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area with polygonal reticulation. *Genae* large, sclerotized ; polygonal reticulation enclosing weaker irregular reticulation ; without setae. *Eyes* : five pairs ; dorsal and ventral pairs large, subequal ; lateral eyes smaller, especially the middle one

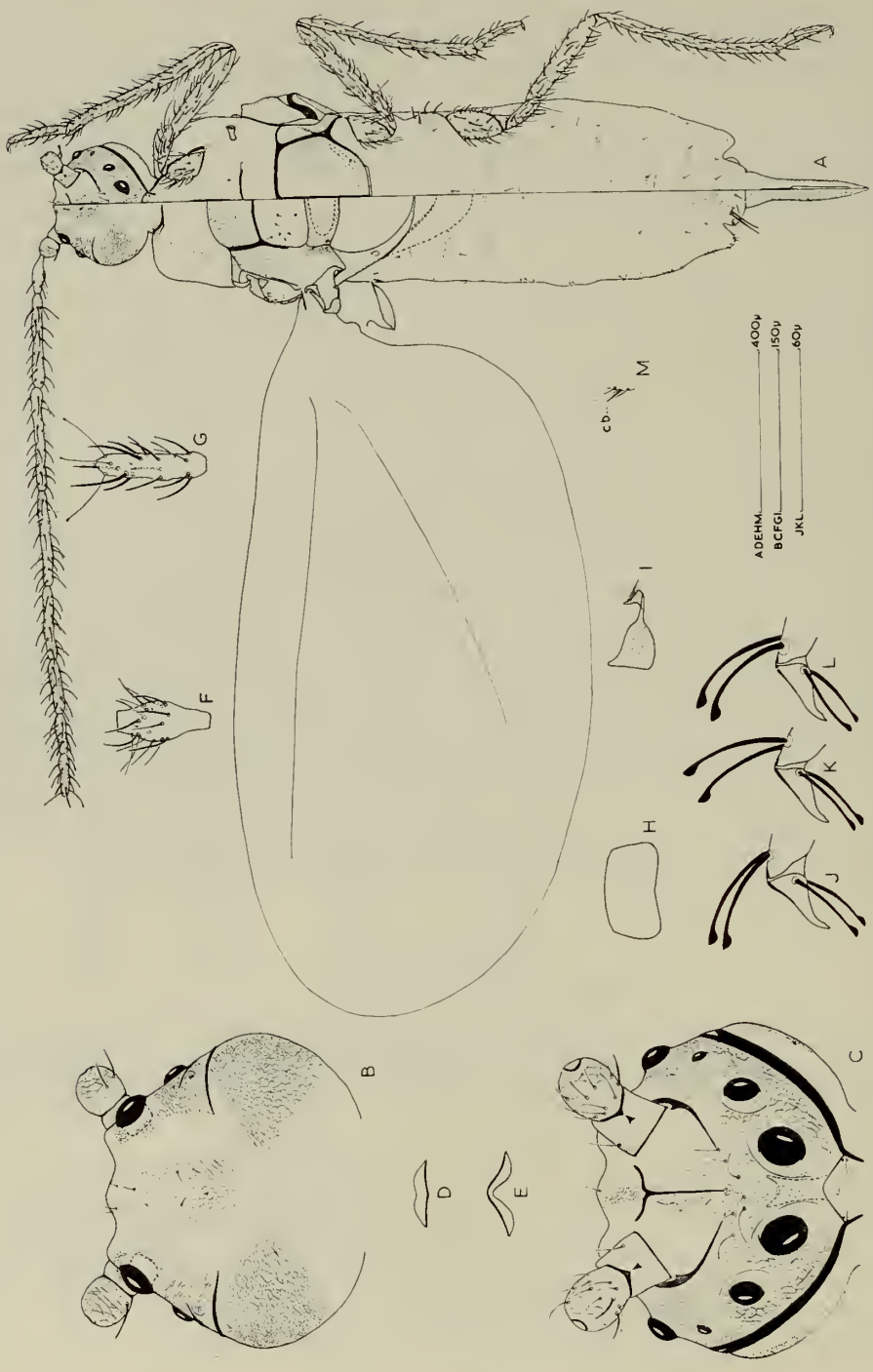


FIG. 14. *Filippia viburni* (Sign.), dorsal and ventral view.

which is about half as big as the other two ; corneae of dorsal eyes 27–30 (average 29) μ in diameter and 3·0–4·3 (average 3·6) times as much apart ; those of the ventral eyes 29–33 (average 30) μ in diameter and 1·2–1·7 (average 1·4) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* with ventral part almost reaching midcranial ridge. *Postocular ridge* tapering dorsally, well developed lateroventrally, and narrow but well defined posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 2–10 (average 6·3) h.s., situated medially just behind the preocular ridges. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate, not reaching the level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 1129–1379 (average 1284) μ long, i.e. longer than half body length (ratio 1 : 1·47–1·75, average 1·58), longer than posterior leg (ratio 1 : 1·06–1·18, average 1·13) and longer than penial sheath (ratio 1 : 3·38–3·94, average 3·74). *Scape* 59–65 (average 62) μ long and 46–51 (average 48) μ wide, with 3–4 (average 3·3) h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 57–65 (average 62) μ long and 49–59 (average 54) μ wide ; with 2–6 (average 3·6) f.s., 7–11 (average 8·4) h.s. and a sensillum placodeum. *Segment* III bulging in the middle, 1·9–2·6 (average 2·1) times longer than wide (76–87, average 80 μ long and 34–39, average 35 μ wide) ; with 4–9 (average 7·1) h.s. and 4–12 (average 7·9) f.s., the latter of medium length, 0·9–1·2 (average 1·1) times as long as width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 194–220 (average 205), 182–247 (average 223), 171–224 (average 204), 129–186 (average 165), 87–118 (average 108) and 72–99 (average 86) respectively, all of about the same width, varying from 21 to 29 μ; with 33–45 (average 38), 37–44 (average 41), 30–49 (average 41), 28–39 (average 33), 7–22 (average 16) and 10–19 (average 14) f.s., and 2–4 (average 3), 3–9 (average 5·1), 2–7 (average 4), 3–6 (average 4·2), 1–4 (average 2·9) and 0–5 (average 2·3) h.s. respectively ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal part not constricted ; 86–99 (average 92) μ long and 23–26 (average 24) μ wide ; carrying 6–12 (average 9) f.s., 0–3 (average 1·1) h.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are up to half as long as the segment and the 2 shorter ones somewhat shorter but distinctly thicker than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 733–794 (average 766) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : sometimes one or two (0–2, average 0·7) h.s. *Post-tergites* narrow, elongated, without striations and without setae. *Pleural structures* typical of the family. *Sternum* with a strong transverse ridge, a long median ridge, which is usually weak and interrupted posteriorly, and a narrow triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* : 1–2 (average 1·7) h.s., usually one on each side.

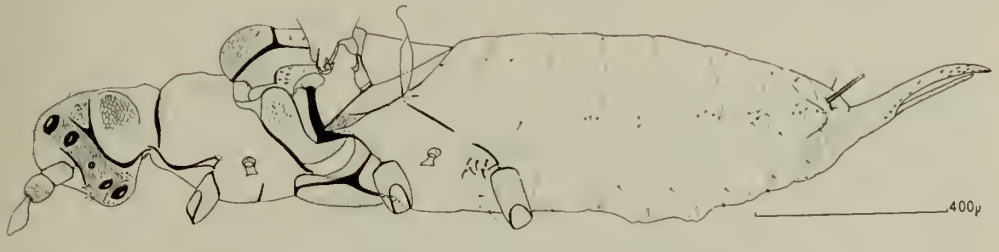


FIG. 15. *Filippia viburni* (Sign.), lateral view.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* more than twice as wide as long (average 237 and 106 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially and irregularly reticulated. *Scutum*. *Median membranous area* subrectangular ; 120–133 (average 128) μ long and 1·54–1·94 (average 1·68) times as wide (width 201–236, average 213 μ) ; with 11–19 (average 15) h.s. *Scutellum* 76–86 (average 82) μ long and 201–228 (210) μ wide, the ratio being 1 : 2·4–2·8 (average 2·6) ; tubular, with large ventral foramen ; without setae. *Postnotum* with anterior margin usually regular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* showing weak, irregular reticulation ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* anteriorly bounded by an extension from marginal ridge. *Basisternum* large, about 293 μ wide and 231 μ long, i.e. 1·66–1·95 (average 1·81) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 5–9 (average 7) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* small, but well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with anterior margin usually weak medially ; *suspensorial sclerites* small, rod-like ; a small, additional sclerite present anterior to postnotum. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : one h.s. on each side. *Pleural ridge* well developed, though interrupted in middle ; with small *wing process*. *Episternum* with anterior margin not ridge-like ; vestigial *precoxal ridge* present ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 4–9 (average 5·5) f.s. and 0–5 (average 2·5) h.s. *Metasternum* represented by a weak, transverse plate. *Anterior* and *posterior metasternal setae* : 0–3 (average 0·8) and 0–1 (average 0·6) h.s. respectively.

Wings hyaline ; long (length 1650–1770, average 1713 μ) and broad (width 750–860, average 818 μ), ratio width to length being 1 : 2·04–2·25 (average 2·09) ; *alar lobe* present ; *alar setae* absent. *Halteres* well developed, 106–133 (average 123) μ long and 23–33 (average 26) μ wide, each with one apically hooked seta which is about 68 μ long.

Legs moderately long and slender, with middle pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·76–1·85 (average 1·80). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	74–84	105–118	258–308	456–483	129–139	23–27	1062–1144
	(78)	(113)	(284)	(467)	(133)	(25)	(1101)
II	91–103	105–118	250–277	418–448	129–137	23–26	1018–1100
	(96)	(113)	(266)	(439)	(134)	(25)	(1072)
III	106–118	110–118	266–289	429–479	127–141	25–29	1068–1163
	(113)	(116)	(276)	(451)	(136)	(26)	(1119)

Coxae each with 21–32 f.s. and 12–23 h.s. ; fore coxa with 1–3 (average 2) pointed coxal bristles which are about ½ as long as the segment ; apical seta about ½ as long as the trochanter. *Trochanters* 34–38 μ wide ; with 6 oval sensilla, 13–20 f.s. and 7–10 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 2·6–3·0 (average 2·7) times as long as width of the trochanter. *Femora* of medium width (46–49 μ), ratio width to length of hind femur being 1 : 5·5–6·3 (average 5·8) ; each with 34–45 f.s. and 18–34 h.s. *Tibiae* 27–30 μ wide, ratio width to length of hind tibia being 1 : 14·1–17·3 (average 15·4) ; each with 94–130 setae, of which 36–50 are h.s. and 56–80 f.s., the latter about as long as width of

tibia ; apical spur about the same size on all tibiae. *Tarsi* 23–27 μ wide, hind tarsus 5·1–5·3 (average 5·2) times longer than wide ; each with 13–19 f.s. and 15–22 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 620–710 (average 669) μ long and 400–500 (average 446) μ wide.

Segments I–VII : *tergites* on segments II–III represented by 3 small sclerites on anterior margin, one medially and one on each side, and on VII by a weak transverse plate in middle of segment ; *sternites* present on all segments, represented by a weak transverse plate on anterior and posterior segments and a small sclerite on each side on intermediate segments. *Caudal extension* of segment VII small, rounded, not sclerotized. *Dorsal setae* : h.s. only, usually one on each side on each of segments I and V–VII and sometimes one or two on IV. *Pleural setae* consisting of h.s. only which include *dorsopleural setae* : up to 3 on II, 2–3 on III and usually 4 (range 3–5) on each of segments IV–VI, and *ventropleural setae* : usually one on segment VI. Segment VII with 6–10 (average 7·3) h.s. *Ventral setae* : h.s. only, occasionally one on each side on II, usually one on each side on III and IV, and 4 on each side of segments V–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is about twice as long as section within pouch. No IXth tergite observed. *Ante-anal setae* ; 2 long h.s. Posterior margin with 3 h.s. on each side.

Genital segment. Penial sheath short, about $\frac{1}{6}$ total body length (ratio 1 : 5·49–6·00, average 5·86), 327–357 (average 342) μ long and 56–63 (average 60) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about half that of aedeagus, the rod extending anteriorly from base of aedeagus to the apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 28–42 (average 33) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (160–186, average 174 μ), penial sheath and basisternum longer, the ratios being 1 : 1·8–2·1 (average 2) and 1 : 1·23–1·39 (average 1·34) respectively.

Material examined : 10 specimens, collected by J. M. Cherret on *Hedera helix* L. (ivy) in Bangor, Wales during May, 1962. Two specimens collected by N. S. Borchsenius in the Crimea, USSR on 24.v.54 agreed well with the above description, but were somewhat smaller, measuring 1680 and 1720 μ. The same is true for 4 specimens collected by J. Řeháček on *Hedera helix* L. during May, 1953 in Czechoslovakia ; they measured 1660, 1680, 1760 and 1830 μ.

CTENOCHITON

Ctenochiton sp.

(Text-figs. 16 and 17)

A moderately small and slender species, with comparatively long antennae and moderately long legs ; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1601–1929 (average 1754) μ ; width at mesothorax 240–280 (average 258) μ. Wing expanse 3052–3265 (average 3178) μ.

Head subconical in dorsal view ; in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced ; length from apex to pronotal ridge 220–258 (average 237) μ, width across genae 240–280 (average 256) μ. *Median crest* sclerotized and striated posteriorly, but not polygonally reticulated ; with 9–15 (average 12) hair-like *dorsal head setae*. *Mid-cranial ridge* dorsally absent ; ventrally narrow but well defined, reaching postocular ridge posteriorly, surrounding area not reticulated. *Genae* large, sclerotized ; polygonal reticulation enclosing weaker, irregular reticulation ; without setae. *Eyes* : four pairs ; dorsal and ventral pairs large, subequal ; lateral pairs smaller, subequal ; corneae of dorsal eyes 19–27

(average 23) μ in diameter and 3·1–5·8 (average 4·6) times as much apart ; those of the ventral eyes 20–27 (average 23) μ in diameter and 1·2–1·6 (average 1·5) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* with ventral part reaching or almost reaching midcranial ridge. *Postocular ridge* thin and tapering dorsally, well developed lateroventrally, and narrow but well defined posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 1–4 (average 2·2) h.s. on each side ; *ventral head setae* : 3–5 (average 4·5) h.s., 2 of which are usually situated anterior to preocular ridge and 2–3 posterior to it. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* short ; apex bifurcate with a central lobe, not reaching level of posterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 1024–1144 (average 1070) μ long, i.e. longer than half body length (ratio 1 : 1·51–1·69, average 1·63), longer than posterior leg (ratio 1 : 1·01–1·05, average 1·04) and longer than penial sheath (ratio 1 : 3·30–3·69, average 3·48). *Scape* 52–60 (average 58) μ long and 40–48 (average 46) μ wide, with 3 h.s. *Pedicel* with weak polygonal, dorsal reticulation ; 44–52 (average 46) μ long and 40–48 (average 45) μ wide ; with 8–14 (average 10) f.s., 4–8 (average 6·3) h.s. and a sensillum placodeum. *Segment* III bulging in the middle, 2·0–2·4 (average 2·2) times longer than wide (52–68, average 61 μ long and 26–32, average 29 μ wide) ; with 2–4 (average 3·1) h.s. and 6–10 (average 8·3) f.s., the latter of medium length, 1·1–1·4 (average 1·3) times as long as width of segment ; with 2–4 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 152–180 (average 166), 148–164 (average 155), 148–180 (average 166), 124–164 (average 147), 100–124 (average 111) and 72–94

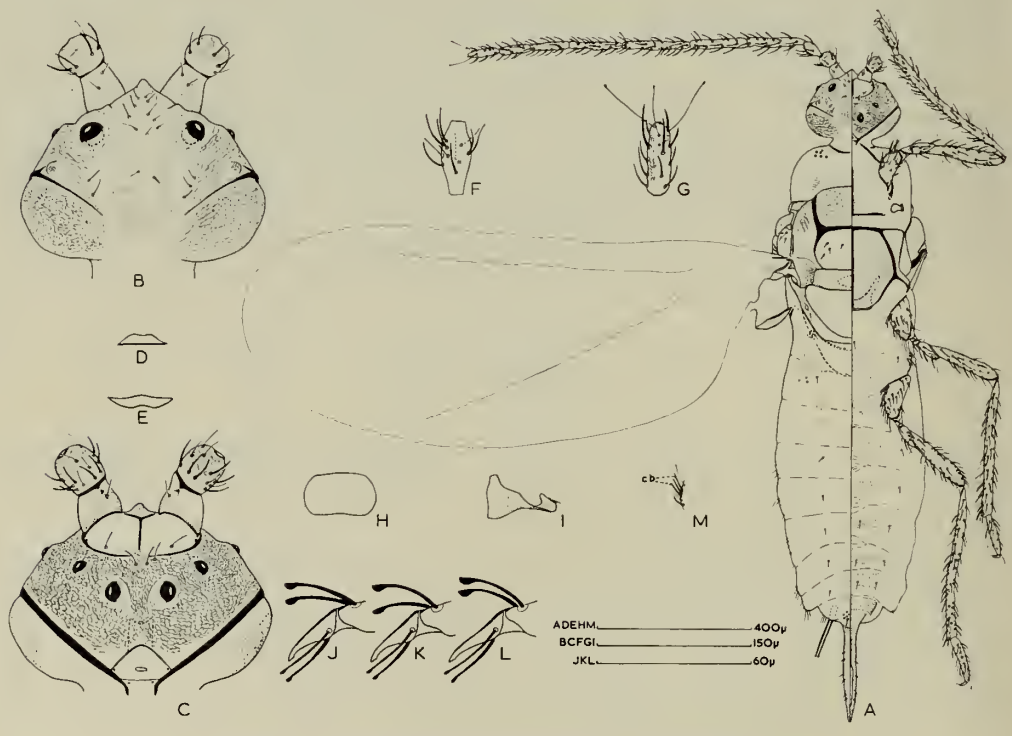


FIG. 16. *Ctenochiton* sp., dorsal and ventral view.

(average 80) respectively, all of about the same width, varying from 19 to 25 μ ; with 27–38 (average 33), 26–32 (average 28), 26–36 (average 30), 21–33 (average 27), 18–26 (average 22) and 11–21 (average 17) f.s., and 1–4 (average 2·3), 1–4 (average 2·2), 1–3 (average 2·3), 1–3 (average 2·1), 0–2 (average 0·6) and 0–2 (average 1) h.s. respectively ; *antennal bristles* on segments VIII–IX distinctly larger than fleshy setae. *Segment* X : terminal part not constricted ; 76–84 (average 80) μ long and 22–26 (average 24) μ wide ; carrying 6–12 (average 10) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about half as long as the segment and the 2 shorter ones somewhat shorter than most fleshy setae, but distinctly thicker ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 584–664 (average 619) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without seate. *Medial pronotal setae* absent ; 3–7 (average 6·1) circular pores present on each side posterior to pronotal sclerite. *Post-tergites* small, without striations, and without setae. *Pleural structures* typical of family. *Sternum* with a strong transverse ridge, a narrow but uninterrupted median ridge and a triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* : occasionally one h.s.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 201 and 98 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; weakly, irregularly reticulated ; slightly more heavily sclerotized medially. *Scutum*. *Median membranous area* subrectangular; 108–128 (average 116) μ long and 1·28–1·78 (average 1·49) times as wide (width 152–192 average 173 μ) ; with 7–13 (average 10) h.s. *Scutellum* 61–87 (average 72) μ long and 160–192 (average 175) μ wide, the ratio being 1 : 2·2–2·8 (average 2·4) ; tubular, with ventral foramen of medium size ; without setae. *Postnotum* with anterior margin usually regular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with shallow emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* showing weak, irregular reticulation ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 253 μ wide and 207 μ long, i.e. 1·60–1·89 (average 1·74) times longer than membranous area of scutum ; with strong mediun ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 4–7 (average 5) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* small, but well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with anterior margin usually strong medially ; *suspensorial sclerites* small, spot-like ; a small, additional sclerite usually present anterior to postnotum. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : one h.s. on each side, 3–11 (average 6·3) circular pores occurring near each seta. *Pleural ridge* well developed,

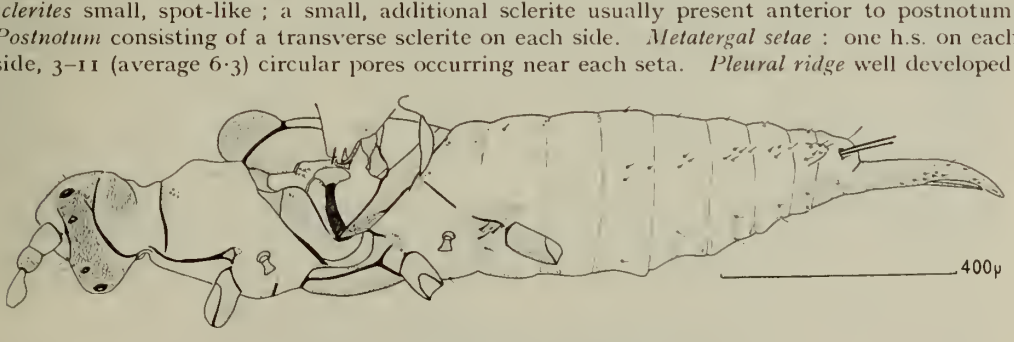


FIG. 17. *Ctenochiton* sp., lateral view.

though interrupted in middle ; with small *wing process*. *Episternum* with anterior margin net ridge-like ; vestigial *precoxal ridge* present ; *epimeron* posteriorly directed. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae ?* 2–6 (average 3·5) f.s. and 1–7 (average 4) h.s. *Metasternum* represented by a weak, transverse plate. *Anterior metasternal setae* : 1–3 (average 1·9) medially situated h.s. ; *posterior metasternal setae* : occasionally one h.s.

Wings hyaline ; long (length 1357–1463, average 1427 μ) and of medium width (530–615, average 578 μ), ratio width to length being 1 : 2·36–2·56 (average 2·46) ; *alar lobe* present ; *alar setae* : one or occasionally two h.s. on each wing. *Halteres* well developed, 104–120 (average 111) μ long and 20–28 (average 24) μ wide, each with one apically hooked seta which is about 64 μ long.

Legs moderately long, and slender, with middle or fore pairs shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·68–1·73 (average 1·71). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	68–76	92–106	198–222	359–422	110–128	23–26	903–1013
	(71)	(100)	(211)	(391)	(119)	(24)	(964)
II	72–84	92–106	178–207	331–414	115–133	24–27	859–1010
	(81)	(99)	(193)	(377)	(124)	(25)	(947)
III	80–91	95–116	190–218	361–426	112–135	24–27	906–1053
	(85)	(104)	(204)	(393)	(125)	(25)	(985)

Coxae each with 13–25 f.s. and 13–19 h.s. ; fore coxa with 2–5 (average 3·8) pointed coxal bristles, the latter about ½ as long as the segment ; apical seta about ½ as long as trochanter. *Trochanters* 26–30 μ wide ; with 6 oval sensilla, 10–16 f.s. and 7–10 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·4–1·7 (average 1·5) times as long as width of trochanter. *Femora* of medium width (38–42 μ), the ratio width to length of hind femur being 1 : 4·7–5·4 (average 5·1) ; each with 22–34 f.s. and 13–26 h.s. *Tibiae* 19–25 μ wide, the ratio width to length of hind tibia being 1 : 16·7–20·0 (average 18·4) ; each with 79–102 setae, of which 30–48 are h.s. and 44–60 f.s., the latter about as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 18–21 (average 19) μ wide, hind tarsus 5·7–7·0 (average 6·3) times longer than wide ; with 9–15 f.s. and 19–32 h.s. ; *tarsal digitules* subequal, about as long as claw. *Claws* of medium length, somewhat longer than width of tarsus ; slightly curved, with a small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 551–721 (average 613) μ long and 371–477 (average 411) μ wide.

Segments I–VII : *tergites* represented by a small sclerite on each side on anterior margin of segments II–III and a weak transverse plate on VII ; *sternites* present on all segments, represented by a weak transverse plate on anterior and posterior segments and a sclerite on each side on intermediate segments. *Caudal extension* of segment VII small, somewhat pointed, not sclerotized. *Dorsal setae* : h.s. only, usually one on each side on segments I, and III–VII ; 1–7 (average 4·1) circular pores occur near each seta on segment I. *Pleural setae* consisting of h.s. only ; *dorsopleural setae* : 2–5 (average 3·3), 3–5 (average 4·1), 3–6 (average 4·6) and 3–5 (average 4·3) on segments III–VI respectively ; *ventropleural* setae absent or incorporated into the dorsopleural group. Segment VII with 5–8 (average 6) h.s., of which the posterior ones are usually longer than the rest. *Ventral setae* : h.s. only, usually one on each side on III–IV, and 4 on each of segments V–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long setae, each with a small apical knob, the protruding part of these setae 3–4 times as long as section within pouch. No IXth tergite observed. *Ante-anal setae* : 2 long and occasionally one small h.s. ; 9–17 (average 14) circular pores present anterior to ante-anal setae. Posterior margin with 3–4 (average 3·3) h.s. on each side.

Genital segment. *Penial sheath* short, about ⅙ total body length (ratio 1 : 5·20–6·12, average 5·75), 285–323 (average 304) μ long and 42–49 (average 46) μ wide ; lateral sclerotizations

narrowly joined anterior to anus ; length of *basal rod* $\frac{2}{3}$–$\frac{4}{5}$ as long as aedeagus and extending anteriorly from the base of aedeagus for about $\frac{2}{3}$ of the length to the apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 17–26 (average 20) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* of medium length (101–120, average 114 μ), penial sheath and basisternum longer, the ratios being 1 : 2·6–3·0 (average 2·7) and 1 : 1·74–1·92 (average 1·85) respectively.

Material examined : 10 specimens, collected by myself on *Antizoma capensis* (Thunb.) in Stellenbosch, South Africa during August, 1961 ; identified by G. De Lotto.

ERICERUS

Ericerus pela (Chavannes)

(Text-figs. 18 and 19)

A very large and moderately robust species, with comparatively long antennae and legs ; with numerous long setae on the appendages, but few on the body itself. When mounted, total body length 2500–3100 (average 2864) μ ; width at mesothorax 570–740 (average 680) μ. Wing expanse 5330–5700 (average 5563) μ.

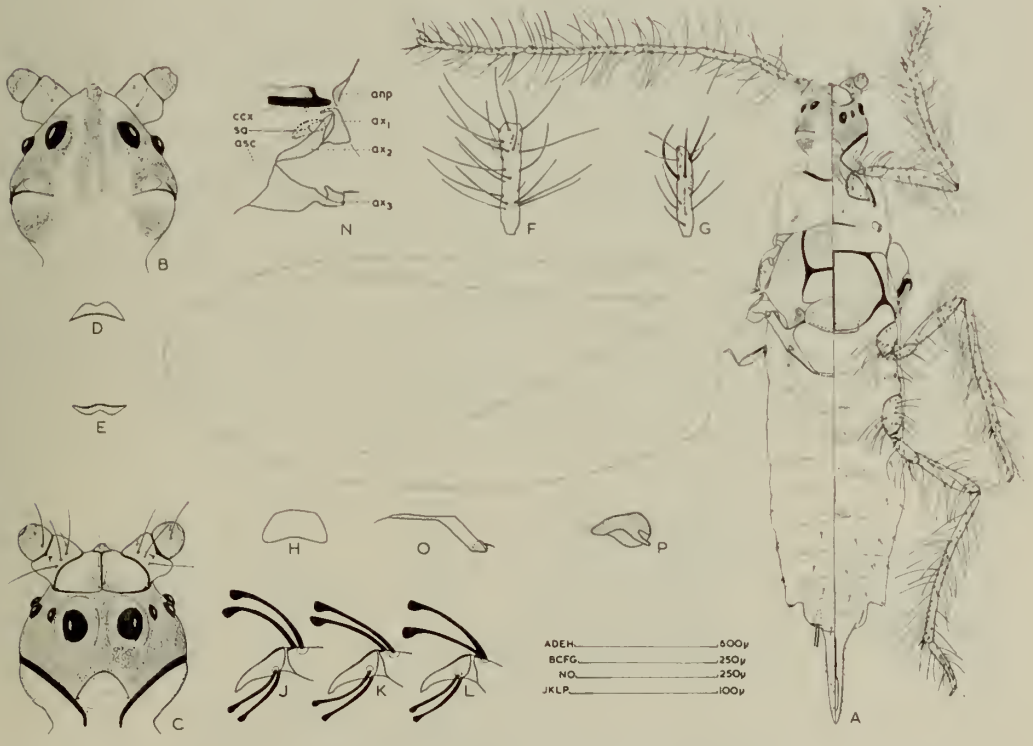


Fig. 18. *Ericerus pela* (Chav.), dorsal and ventral view.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated ; long and narrow, length from apex to pronotal ridge 357–456 (average 420) μ and width across genae 285–342 (average 315) μ. *Median crest* sclerotized and densely polygonally reticulated ; with 5–7 (average 5·7) hair-like *dorsal head setae* anteriorly. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area polygonally reticulated. *Genae* large, sclerotized ; polygonal reticulation enclosing weaker, irregular reticulation ; without setae. *Eyes* : five pairs ; dorsal and ventral pairs large, subequal ; lateral pairs smaller, subequal ; corneae of dorsal eyes 40–47 (average 43) μ in diameter and 1·4–2·1 (average 1·7) times as much apart, those of the ventral eyes 42–49 (average 46) μ in diameter and 0·9–1·1 (average 1) times as much apart. *Ocellus* small. *Ocular* sclerite well sclerotized and densely polygonally reticulated throughout. *Preocular ridge* with ventral part reaching or almost reaching midcranial ridge. *Postocular ridge* weak dorsally, well developed lateroventrally, and narrow but well defined posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* absent ; *ventral head setae* : 3–5 (average 4·4) h.s., situated anterior to ocular sclerite on or near midcranial ridge. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* short ; apex truncate, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 1691–2120 (average 1922) μ long, i.e. longer than half body length (ratio 1 : 1·46–1·55, average 1·50), longer than posterior leg (ratio 1 : 1·10–1·17, average 1·13) and longer than penial sheath (ratio 1 : 3·50–4·04, average 3·89). *Scape* 80–99 (average 93) μ long and 76–95 (average 86) μ wide, with 3 h.s. and 2–4 (average 2·6) f.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; small, 61–84 (average 73) μ long and 57–68 (average 64) μ wide ; with 1–3 (average 2·1) f.s., 2–4 (average 2·6) h.s. and a sensillum placodeum. *Segment* III long, cylindrical, 4·6–6·3 (average 5·3) times longer than wide (209–258, average 228 μ long and 38–48, average 43 μ wide) ; with 6–11 (average 8·3) h.s. and 15–26 (average 21) f.s., the latter, as on the other antennal segments, very long, 4–5 (average 4·5) times as long as width of segment III ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 213–274 (average 248), 235–281 (average 264), 232–312 (average 277), 194–274 (average 235), 156–205 (average 186) and 118–156 (average 145) respectively, all of about the same width, varying from 27 to 38 μ ; with 15–28 (average 21), 17–26 (average 23), 18–31 (average 24), 18–26 (average 22), 12–18 (average 15) and 9–14 (average 12) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly thicker than f.s. ; one or two f.s. near apex of each segment short, shorter than width of segment. *Segment* X : terminal part not constricted ; 125–213 (average 172) μ long, and 29–34 (average 31) μ wide ; carrying 6–11 (average 8·2) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about $\frac{2}{3}$ as long as the segment and the 2 short ones thin and shorter than the f.s. (one shorter than the other, about as long as width of segment) ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 832–1113 (average 1015) μ long.

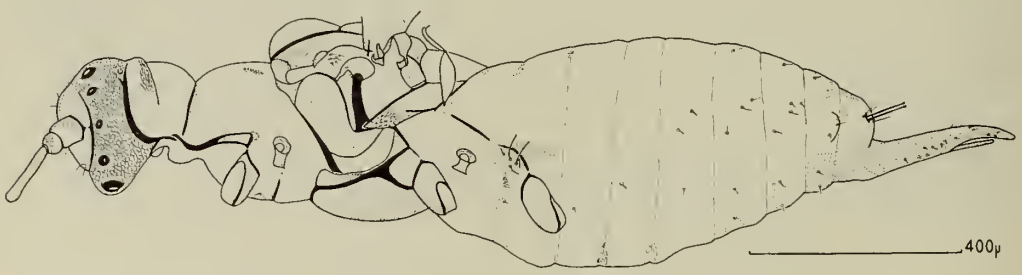


Fig. 19. *Ericerus pela* (Chav.), lateral view.

Prothorax. *Pronotal ridge* strong, but narrowly constricted medially. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* absent. *Post-tergites* elongated, with wavy striations and without setae. *Pleural structures* typical of the family. *Sternum* with transverse ridge strong, median ridge reduced to a short basal stalk and triangular sclerite well sclerotized. *Anteprosternal setae* absent ; *prosternal setae* : 0–4 (average 1·8) h.s.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* less than twice as wide as long (average 287 and 185 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; with weak, irregular reticulation ; slightly more heavily sclerotized medially. *Scutum*. *Median membranous area* trapezoidal ; 108–186 (average 156) μ long and 1·57–2·40 (average 1·95) times as wide (width 247–334, average 298 μ) ; without setae. *Scutellum* large, 76–114 (average 96) μ long and 209–293 (average 250) μ wide, ratio being 1 : 1·4–1·8 (average 1·6) ; not tubular ; without setae. *Postnotum* with anterior margin irregular and partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 430 μ wide and 356 μ long, i.e. 2·08–2·81 (average 2·31) times longer than membranous area of scutum; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a weak sclerite posteriorly and 2–7 (average 4·7) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* elongated, well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with anterior margin usually strong medially ; *suspensorial sclerites* small, spot-like ; a small, additional sclerite present anterior to postnotum. *Postnotum* consisting of a narrow, transverse sclerite on each side. *Metatergal setae* absent. *Pleural ridge* well developed, though interrupted in middle ; with small *wing process*. *Episternum* with anterior margin not ridge-like ; *precoxal ridge* absent ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 0–3 (average 1) f.s. and 4–8 (average 5·6) h.s. ; of the latter 3–7 are situated dorsally and one or two more ventrally. *Metasternum* represented by a weak transverse plate. *Anterior* and *posterior metasternal setae* absent.

Wings hyaline ; long (length 2350–2530, average 2490 μ) and of medium width (890–950, average 911 μ), ratio width to length being 1 : 2·64–2·77 (average 2·68) ; *alar lobe present* ; *alar setae* absent. *Halteres* well developed, 163–228 (average 202) μ long and 42–61 (average 52) μ wide, each with 1–4 (average 2·3) apically hooked setae which are about 97 μ long.

Legs long and slender, with middle pair shortest and hind pair longest ; ratio length of hind leg to body is 1 : 1·54–1·73 (average 1·65). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	106–137	114–186	334–426	562–760	194–266	38–48	1379–1804
	(119)	(171)	(389)	(678)	(242)	(45)	(1643)
II	106–141	114–186	308–388	543–749	179–251	40–49	1321–1763
	(124)	(164)	(353)	(669)	(227)	(46)	(1584)
III	114–156	160–198	334–419	608–798	188–304	40–49	1444–1908
	(136)	(176)	(384)	(734)	(249)	(47)	(1726)

Coxae with 14–22 f.s. on fore and middle coxa and 17–32 (average 25) on the hind coxa, and with 12–23 (average 18) h.s. on fore coxa and 8–15 on the middle and hind coxa ; fore coxa without coxal bristles ; apical setae about half as long as the trochanter. *Trochanters* 42–68 μ wide, with 6–8 oval sensilla, 7–12 f.s. and 7–9 h.s., the latter including 2 minute setae near basal

ridge, one small seta on the outer margin and a long apical seta which, on the fore trochanter, is 1·5–1·9 (average 1·7) times as long as width of trochanter. *Femora* of medium width (60–87 μ), ratio width to length of hind femur being 1 : 4·7–5·5 (average 5·1) ; each with 25–43 f.s., with 16–21 (average 18) h.s. on the fore and 10–16 on the middle and hind legs. *Tibiae* 34–49 μ wide, the ratio width to length of hind tibia being 1 : 16·2–18·2 (average 17·1) ; each with 72–99 setae of which 17–29 are h.s. and 53–72 f.s. ; the latter, as on the other segments, very long, about 4–5 times as long as width of tibia ; with a number of spurs near apex, apical spur about the same size on all tibiae. *Tarsi* 29–38 μ wide, hind tarsus 6·2–8·9 (average 7·3) times longer than wide ; each with 12–19 f.s. and 8–15 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, somewhat longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 800–1060 (average 982) μ long and 600–780 (average 681) μ wide.

Segments I–VII : *tergites* on segments II–III represented by a small sclerite on each side, and on VII by a weak transverse plate ; *sternites* on segments V–VII represented by a weak transverse plate. *Caudal extension* of segment VII small, somewhat pointed, not sclerotized. *Dorsal setae* : h.s. only, sometimes one on each side on segment IV and usually so on V–VII. *Pleural setae* consisting of h.s. only, which include *dorsopleural setae* : 1, 1–2 (average 1·2), 1–3 (average 1·7) and 3 on segments III–VI respectively, and *ventropleural setae* : usually one on each of segments IV–VI. Segment VII with 4 h.s. *Ventral setae* : h.s. only, usually one on each side on each of segments II–IV, and 3–5 on V–VII.

Segment VIII with transverse tergite and sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long setae, each with a small apical knob, the protruding part of these setae 1–1½ times as long as section within pouch. No IXth tergite observed. *Ante-anal setae* : 2 long h.s. Posterior margin with 3 h.s. on each side.

Genital segment. *Penial sheath* short, about ⅙ total body length (ratio 1 : 5·26–6·20, average 5·81), 441–536 (average 492) μ long and 61–68 (average 65) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about equal that of aedeagus, extending anteriorly from base of aedeagus to apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 26–41 (average 34) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (length 137–171, average 162 μ), penial sheath and basisternum longer, ratios being 1 : 2·8–3·2 (average 3) and 1 : 1·81–2·44 (average 2·17) respectively.

Material examined : 10 specimens, collected by N. S. Borchsenius on *Ligustrum* sp. in China on 14.ix.54.

Genus *A* sp.

(Text-figs. 20 and 21)

A medium-sized, robust species with comparatively long antennae and moderately long legs ; with numerous short, thick setae on the appendages but with only a few h.s. on the body itself. When mounted, total body length 1630–1830 (average 1757) μ ; width at mesothorax 455–500 (average 477) μ. Wing expanse 3140–3220 (average 3172) μ.

Head subconical in dorsal view ; rounded in lateral view, with anterodorsal bulge not pronounced ; length from apex to pronotal ridge 213–236 (average 218) μ, width across genae 277–304 (average 286) μ. *Median crest* well sclerotized, especially anteriorly and around the posterior margin ; central part polygonally reticulated ; with 7–10 (average 8·5) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area sometimes weakly sclerotized near ridge, but not reticulated. *Genae* large, sclerotized, not reticulated, without setae. *Eyes* : four pairs ; dorsal and ventral pairs large, subequal ; lateral pairs smaller, subequal ; corneae of dorsal eyes 21–23 (average 22) μ in diameter and 6·8–7·8 (average 7·2) times as much apart ;

those of the ventral eyes 19–23 (average 21) μ in diameter and 2·8–3·3 (average 3·1) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* with ventral part reaching midcranial ridge. *Postocular ridge* weak dorsally, well developed lateroventrally and narrow but well defined posteromedially ; below ocellus the ridge splits up, with the posterior part weak or lost entirely and the anterior part strong, extending anterior to ocellus. *Interocular ridge* usually present, narrow, connecting pre- and postocular ridges between lateral eyes (ridge sometimes absent on one side and occasionally on both sides). *Dorsal ocular setae* absent ; *ventral head setae* : 3–5 (average 4) h.s., situated on or just anterior to preocular ridge, a pair of these being considerably longer than the others. *Preoral ridge* absent. *Tendon-like apodeme* long, arising from the anterior part of an elongated ventral sclerite. *Cranial apophysis* very short, apex truncate with a large, irregular central lobe. *Mouth opening* irregular. *Anterior tentorial pits* situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 1003–1144 (average 1101) μ long, i.e. longer than half body length (ratio 1 : 1·62–1·74, average 1·68), longer than posterior leg (ratio 1 : 1·16–1·19, average 1·17) and longer than penial sheath (1 : 3·06–3·40, average 3·18). *Scape* 61–72 (average 66) μ long and 57–63 (average 60) μ wide, with 3–6 (average 4·1) h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 57–68 (average 64) μ long and 53–63 (average 59) μ wide ; with 7–14 (average 10) f.s., 8–15 (average 11) h.s. and a sensillum placodeum. *Segment* III bulging in middle, 1·7–2·1 (average 1·9) times longer than wide (76–95, average 84 μ long and 38–46, average 43 μ wide) ; with 6–8 (average 7) h.s. and 21–31 (average 24) f.s., the latter, as on the other antennal segments, very short, about 0·4–0·6 (average 0·5) times as long as width of segment III ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of

FIG. 20. Genus *A*, dorsal and ventral view.

these segments (in μ) 137–164 (average 149), 141–175 (average 155), 156–175 (average 165), 118–148 (average 135), 95–122 (average 113) and 76–91 (average 85) respectively, all of about the same width, varying from 29 to 38 μ ; with 35–48 (average 42), 40–51 (average 47), 46–53 (average 48), 36–48 (average 42), 30–41 (average 33) and 20–28 (average 25) f.s., and 5–10 (average 8), 5–8 (average 6·7) 5–12 (average 7·7), 4–6 (average 4·6), 3–5 (average 4) and 0–4 (average 2·3) h.s. respectively ; *antennal bristles* on segments VIII–IX not distinctly different from the f.s. *Segment* X : terminal part not constricted ; 84–91 (average 86) μ long and 57–68 (average 63) μ wide ; carrying 5–10 (average 7·3) f.s., 0–2 (average 1·5) h.s., 4–6 (average 5) capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are less than half as long as the segment and the 2 short ones about as long as the f.s. though thinner ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 593–665 (average 637) μ long.

Prothorax. *Pronotal ridges* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* absent. *Post-tergites* small, without striations and without setae. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, a median ridge which is occasionally interrupted in the middle, and a well sclerotized triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* : occasionally one h.s. on each side.

Mesothorax. *Mesoprephragma* with shallow emargination. Prescutum more than twice as wide as long (average 228 and 90 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; with polygonal reticulation ; slightly more heavily sclerotized medially. *Scutum*. *Median membranous area* subrectangular; 96–114 (average 100) μ long and 2·00–2·82 (average 2·38) times as wide (width 205–236, average 221 μ) ; with 9–13 (average 12) h.s., usually with one on each side situated posterolaterally immediately outside the membranous area. *Scutellum* large, 110–125 (average 118) μ long and 201–235 (average 220) μ wide, the ratio being 1 : 1·8–2·1 (average 1·9) ; not tubular ; with 0–2 (average 1·6) h.s. *Postnotum* with anterior margin irregular and partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, but interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Laterotergite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 262 μ wide and 183 μ long, i.e. 1·57–2·49 (average 1·92) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal* ridges ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. Tegula small, membranous bulge with a weak sclerite posteriorly and 7–11 (average 8·8) h.s. *Third axillary wing sclerite* with a large ventral projection at its base. *Additional sclerite* elongated, well defined. *Antemetaspiracular setae* absent.

FIG. 21. Genus *A*, lateral view.

Metathorax. *Metanotum* with anterior margin usually strong medially ; *suspensorial sclerites* small, spot-like ; a small, additional sclerite occasionally present anterior to postnotum. *Postnotum* consisting of a transverse sclerite, which is narrow medially but usually not interrupted. *Metatergal setae* : one or two h.s. on each side. *Pleural ridge* well developed, but usually interrupted in the middle ; with a small *wing process*. *Precoxal ridge* absent. *Episternum* ventrally interrupted so that a small, separate sclerite is formed ; anterior margin not ridge-like. *Epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : occasionally one or two h.s. *Metasternum* represented by a transverse plate. *Anterior* and *posterior metasternal setae* : usually one median h.s. each.

Wings hyaline ; of medium length (1370-1420, average 1394 μ) and broad (610–655, average 630 μ), the ratio width to length being 1 : 2·17–2·26 (average 2·21) ; *alar lobe* present ; *alar setae* absent. *Halteres* well developed, 125–144, (average 136) μ long and 30–36 (average 34) μ wide, each with one apically hooked seta which is about 70 μ long.

Legs moderately long and slender, with fore pair shortest and the middle or hind pair longest; ratio length of hind leg to body length is 1 : 1·82–2·01 (average 1·89). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	76–87	87–103	209–224	338–384	91–103	25–27	842–920
	(82)	(99)	(217)	(364)	(100)	(26)	(888)
II	76–91	93–106	191–231	376–440	103–110	25–29	865–954
	(87)	(102)	(209)	(395)	(108)	(27)	(928)
III	76–91	91–114	192–227	357–418	108–112	25–27	859–969
	(87)	(106)	(215)	(390)	(110)	(26)	(927)

Coxae with 10–13 (average 11), 11–19 (average 15) and 14–25 (average 18) f.s. on the fore, middle and hind coxa respectively, and with 11–21 h.s. each ; fore coxa with 2–4 (average 3) coxal bristles ; apical seta about half as long as trochanter. *Trochanters* 30–40 μ wide ; with 6 oval sensilla, 5–10 f.s. and 6–11 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·2–1·5 (average 1·4) times as long as width of trochanter. *Femora* very broad (46–65 μ), ratio width to length of hind femur being 1 : 3·2–3·8 (average 3·5) ; each with 32–54 f.s. and 15–31 h.s. *Tibiae* 30–34 μ wide, ratio width to length of hind tibia being 1 : 10·4–12·2 (average 11·5) Setae : 83–135, of which 35–59 are h.s. and 48–81 f.s., the latter, as on the other segments, very short and thick, about ⅔ as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 25–30 μ wide, hind tarsus 3·6–4·1 (average 3·7) times longer than wide ; each with 21–40 h.s., with 0–5 (average 1·8) f.s. on the fore and none on the middle and hind tarsi ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw. *Abdomen* 540–620 (average 577) μ long and 430–510 (average 459) μ wide.

Segments I–VII : *tergites* represented by a transverse sclerite on anterior margin of segments II, III and sometimes IV ; *sternites* represented by a weak transverse plate on segments II, III and V–VII. *Caudal extension* of segment VII small, somewhat pointed, not sclerotized. *Dorsal setae* : h.s. only, usually one on each segment. *Pleural setae* : consisting of h.s. only, which include *dorsopleural setae* : 0–2 (average 1·6), 1–4 (average 2·1), 2–4 (average 3·3) and 0–4 (average 2·9) on segments III–VI respectively, and *ventropleural setae* : sometimes one on each of segments IV–VI. Segment VII with 3–9 (average 5·4) h.s. *Ventral setae* : h.s. only, usually one on each side on each of segments III–V, 4 on VI and 4–6 (average (5·6) on VII ; two of the median setae on segment VII considerably longer than rest.

Segment VIII with small tergite and transverse sternite ; *glandular pouch* with 2 long setae, each with a small apical knob, the protruding part of these setae 2–2½ times as long as section within pouch. No IXth tergite observed. *Ante-anal setae* absent. Posterior margin with 3 h.s. on each side.

Genital segment. *Penial sheath* of medium length, about $\frac{1}{5}$ total body length (ratio 1 : 4·80–5·32, average 5·04), 315–369 (average 349) μ long and 53–61 (average 57) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about $\frac{5}{8}$ to equal that of aedeagus and extending anteriorly from base of the latter to apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 36–46 (average 40) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (125–148, average 140 μ) and broad, penial sheath and basisternum longer, ratios being 1 : 2·4–2·6 (average 2·5) and 1 : 1·21–1·42 (average 1·31) respectively.

Material examined : 7 specimens, collected by C. J. Joubert on " katdoring " (*Asparagus* sp.) during August, 1956 in Stanford, South Africa ; received from J. G. Theron.

SPHAEROLECANIUM

Sphaerolecanium prunastri (Fonscolombe)

(Text-figs. 22 and 23)

A medium-sized, robust species with comparatively short antennae and legs ; with many setae on the appendages, but few on the body itself. When mounted, total body length 1640–1810 (average 1739) μ ; width at mesothorax 360–430 (average 408) μ. Wing expanse 2750–2940 (average 2816) μ.

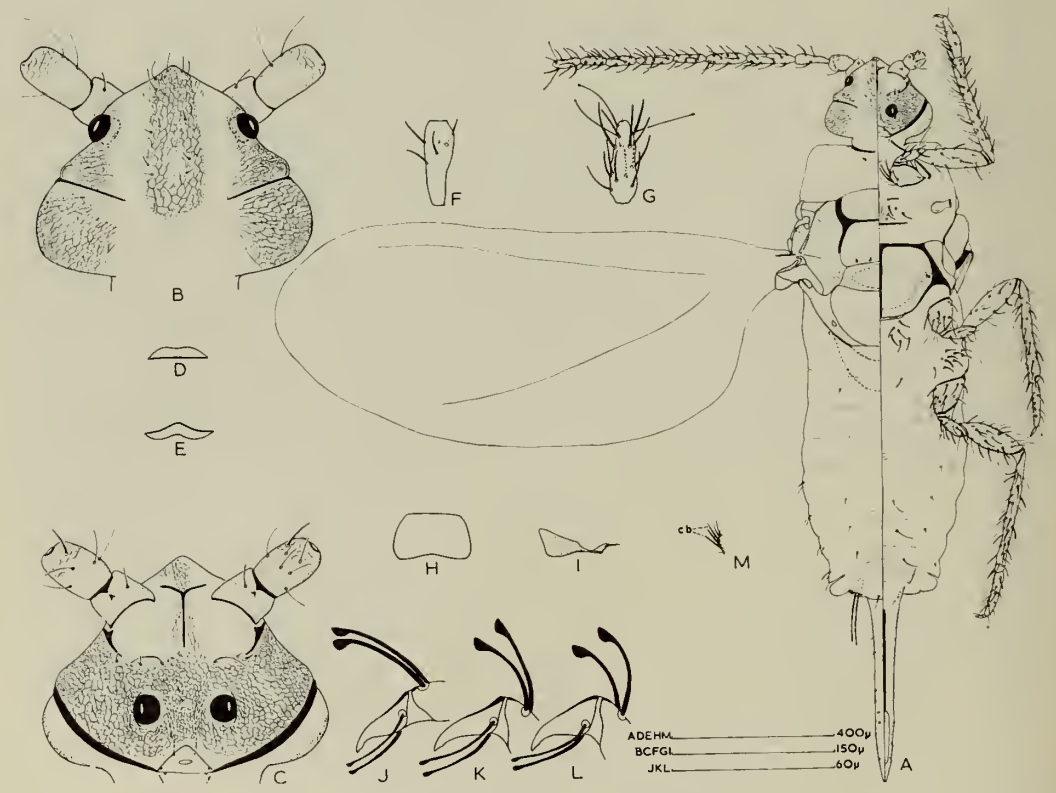


FIG. 22. *Sphaerolecanium prunastri* (Fonsc.), dorsal and ventral view.

Head subconical in dorsal view ; in lateral view obliquely elongated dorsoventrally, with, anterodorsal bulge somewhat pronounced ; length from apex to pronotal ridge 205–247 (average 222) μ, width across genae 243–266 (average 253) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 9–12 (average 10) hair-like *dorsal head setae*, arranged in a group of 3–5 near anterior margin of head and a group of 5–7 very short setae more posteriorly. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area with polygonal reticulation. *Genae* large, sclerotized, polygonally reticulated, without setae. *Eyes* : two pairs ; subequal ; corneae of dorsal eyes 19–27 (average 25) μ in diameter and 3·4–4·2 (average 3·9) times as much apart ; those of the ventral eyes 19–27 (average 26) μ in diameter and 1·2–1·6 (average 1·3) times as much apart. *Ocellus* small, bulging. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* short, not extending far below articular process. *Postocular ridge* well developed dorsally and lateroventrally, but weak posteromedially ; below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. *Interocular ridge* absent, but sometimes indicated by a line of dark sclerotization. *Dorsal ocular setae* absent; *ventral head setae* : 4–6 (average 5) h.s., situated on the anterior margin or just anterior to the ocular sclerite ; with one pair of setae distinctly longer than others. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate with a central lobe, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* apparently present anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 671–809 (average 770) μ long, i.e. shorter than half body length (ratio 1 : 2·13–2·45, average 2·28), longer than posterior leg (ratio 1 : 0·95–0·96) and longer than penial sheath (ratio 1 : 1·55–1·73, average 1·62). *Scape* 45–53 (average 47) μ long and 46–49 (average 47) μ wide, with 3–4 (average 3·4) h.s. *Pedicel* with weak, polygonal, dorsal reticulation ; 55–68 (average 63) μ long and 32–42 (average 38) μ wide, with 0–3 (average 1·2) f.s., 4–9 (average 6·8) h.s. and a sensillum placodeum. *Segment* III club-shaped, 2·7–3·7 (average 3·1) times longer than wide (68–86, average 78 μ long and 23–29, average 26 μ wide) ; with 4–7 (average 6) f.s. of medium length, 1·1–1·3 (average 1·2) times as long as width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 106–133 (average 121), 76–133 (average 95), 72–91 (average 84), 70–95 (average 83), 61–76 (average 67) and 53–72 (average 66) respectively, widths varying from 21 to 27 μ, with distal segments wider than proximal ones ; with 18–27 (average 21), 13–24 (average 16), 13–23 (average 17), 12–18 (average 16), 12–19 (average 15) and 10–17 (average 15) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX not distinctly different from f.s., sometimes slightly thicker. *Segment* X : terminal part not constricted ; 57–72 (average 65) μ long and 21–27 (average 23) μ wide ; carrying 9–15 (average 12) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about half as long as the segment and the 2 shorter ones not distinctly different from the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 513–597 (average 566) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* medium-sized, without setae. *Medial pronotal setae* : usually 2 h.s. *Post-*

FIG. 23. *Sphaerolecanium prunastri* (Fonsc.), lateral view.

tergites very small and weakly sclerotized, without striations and without setae. *Pleural structures* typical of family. *Sternum* with transverse ridge strong, median ridge absent (occasionally a small basal stalk may be present) and triangular sclerite with lines arching latero-anteriorly. *Anteprosternal setae* absent ; *prosternal setae* : 7–16 (average 11) f.s. and 0–2 (average 0·7) h.s., scattered over the sternal area but not occurring anterior to the spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* more than twice as wide as long (average 181 and 82 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially but not reticulated. *Scutum*. *Median membranous area* subrectangular ; 72–91 (average 83) μ long and 1·92–2·48 (average 2·11) times as wide (width 152–220, average 175 μ); with 2–4 (average 2·8) h.s. *Scutellum* 65–80 (average 74) μ long and 141–182 (average 163) μ wide, ratio being 1 : 2·0–2·3 (average 2·2) ; tubular, with a large ventral foramen ; occasionally with one or two h.s. *Postnotum* with anterior margin irregular and partly overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with moderately deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* not bounded by an extension from marginal ridge. *Basisternum* large, about 236 μ wide and 170 μ long, i.e. 1·8–2·2 (average 2·1) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and 4–10 (average 7·3) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with anterior margin desclerotized medially ; *suspensorial sclerites* absent. *Postnotum* consisting of a transverse sclerite on each side. *Metatergal setae* : usually one h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 0–15 (average 7·5) f.s. and 1–3 (average 1·2) h.s. *Metasternum* represented by two small, irregular sclerites. *Anterior metasternal setae* : 11–18 (average 14) f.s. and occasionally one h.s. ; *posterior metasternal setae* : 0–3 (average 1·6) f.s.

Wings hyaline ; short (length 1200–1280, average 1231 μ) and of medium width (500–530, average 516 μ), the ratio width to length being 1 : 2·34–2·42 (average 2·38) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and moderately slender, with fore pair usually shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 2·02–2·34 (average 2·17). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	59–72	76–95	175–209	239–293	91–110	26–28	667–803
	(67)	(87)	(197)	(280)	(103)	(27)	(759)
II	62–76	84–103	160–190	251–304	106–118	27–30	690–813
	(70)	(95)	(179)	(281)	(113)	(28)	(766)
III	65–82	84–106	171–201	255–317	101–125	27–32	701–851
	(76)	(100)	(189)	(295)	(116)	(30)	(805)

Coxae 3–6 (average 4·6) f.s. on the fore and 10–20 on the middle and hind coxa, and 10–20 h.s. on each ; fore coxa with 3–6 (average 4) pointed coxal bristles (about as long as segment) ; apical seta about $\frac{2}{3}$ as long as trochanter. *Trochanters* 30–34 μ wide ; with 6 oval sensilla, 6–10 f.s. and 5–9 h.s., the latter including 2 minute setae near basal ridge, one small seta on

outer margin and a long apical seta which, on the fore trochanter, is 2·1–2·9 (average 2·4) times as long as width of trochanter. *Femora* very wide (46–57 μ), ratio width to length of hind femur being 1 : 3·3–3·8 (average 3·5) ; each with 8–16 f.s. and 17–28 h.s. *Tibiae* 23–30 μ wide, ratio width to length of hind tibia being 1 : 10·3–11·5 (average 10·9) ; each with 47–75 setae of which 31–49 are h.s. and 10–26 f.s., the latter about as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 21–25 μ wide, hind tarsus 4·8–5·5 (average 5·2) times longer than wide ; each with 1–6 f.s. and 15–27 h.s. ; *tarsal digitules* subequal, longer than claw. *Claws* of medium length, longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 470–530 (average 498) μ long and 320–420 (average 375) μ wide.

Segments I–VII : *tergites* represented by a small sclerite on each side on anterior margin of segments II–III and by a weak plate on VI–VII ; *sternites* represented by a small sclerite on each side on segments II–III and a transverse plate on VI. *Caudal extension* of segment VII small, pointed, not sclerotized. *Dorsal setae* : h.s. only, usually one on each side on I and each of segments V–VII. *Pleural setae* on segments III–VI consisting of 0–1 (average 0·1), 0–1 (average 0·1), 0–2 (average 0·5) and 0–2 (average 0·9) f.s., and 0–2 (average 0·7), 0–3 (average 1·8), 1–3 (average 2·1) and 1–4 (average 1·9) hair-like *dorsopleural setae* respectively ; *ventropleural setae* absent or incorporated into the dorsopleural group. Segment VII with 0–2 (average 1·1) f.s. and 3–5 (average 3·4) h.s. *Ventral setae* : 1–5 (average 2·3) f.s. on segment II, occasionally one on III, and usually one h.s. on each side on II–IV and 4 on each of segments V–VII.

Segment VIII with transverse tergite and sternite, and with a large, cylindrical, caudal extension ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2⅓–3 times as long as section within pouch. No IXth tergite observed. *Ante-anal setae* : 2 long h.s. Posterior margin with 3 h.s. on each side.

Genital segment. *Penial sheath* long, about ⅔ total body length (ratio 1 : 3·42–3·85, average 3·68), 433–517 (average 473) μ long and 46–51 (average 48) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* 1¾–2 times that of aedeagus and extending anteriorly from base of the latter to apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 27–30 (average 32) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* of medium length (114–152, average 140) μ, penial sheath and basisternum longer, the ratios being 1 : 3·1–3·8 (average 3·4) and 1 : 1·15–1·32 (average 1·23) respectively.

Material examined : 10 specimens, collected by B. Ogaza on *Prunus spinosa* L. in Cracow, Poland during March, 1962 ; received from Z. Kawecki. A number of specimens received from N. S. Borchsenius (collected by A. Kiritchenko in the Odessa district, USSR in 1928) agreed well with the above description, but the medial pronotal setae were not observed in any of the 10 specimens examined. These specimens were generally in a poor condition (they were kept dry on cotton wool), with many setae broken off.

The *ERIOPELTIS* Group

ERIOPELTIS

Eriopeltis sp.

(Text-figs. 24 and 25)

Living specimens light reddish brown ; short, slender with comparatively long antennae and short legs ; with many setae on the body and appendages. When mounted, total body length 1510–1590 (average 1550) μ ; width at mesothorax 260–290 (average 281) μ. Wing expanse 2730–2930 (average 2839) μ.

Head subconical in dorsal view ; in lateral view flat, not obliquely elongated dorsoventrally, anterodorsal bulge not pronounced ; length from apex to pronotal ridge 186–205 (average 199) μ, width across genae 182–198 (average 190) μ. *Median crest* sclerotized, distinctly polygonally reticulated, with 7–11 (average 9) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally reduced to a shorter or longer median bar with lateral arms, surrounding area sclerotized and showing distinct polygonal reticulation. *Genae* large, weakly sclerotized, with distinct polygonal reticulation ; without setae. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 19–25 (average 22) μ in diameter and 2·7–3·4 (average 3) times as much apart ; those of the ventral eyes 19–25 (average 22) μ in diameter and 1·2–1·8 (average 1·4) times as much apart. *Ocellus* small, situated on a distinct protuberance which overhangs the postocular ridge. *Ocular sclerite* well sclerotized, distinctly polygonally reticulated throughout. *Preocular ridge* long, the ridges of each side ventrally meeting or almost meeting each other medially. *Postocular ridge* well developed throughout. *Interocular ridge* broadly joining pre- and postocular ridges below ocellus. *Dorsal ocular setae* absent. *Ventral head setae* : 9–16 (average 13) f.s. and 5–9 (average 6·9) h.s., arranged in a broad band on anterior part of ocular sclerite, occasionally with some (0–3, average 0·7) f.s. and some (0–1, average 0·5) h.s. occurring in the area anterior to this sclerite, but with none between the eyes. *Preoral ridge* absent. *Tendon-like apodeme* variable, occasionally fully developed, but usually reduced or absent. *Cranial apophysis* of medium length ; apex trifurcate, extending to around the margin of the posterior level of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* present, situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 1030–1284 (average 1125) μ long, i.e. longer than half body length (ratio 1 : 1·23–1·51, average 1·38), longer than posterior leg (ratio 1 : 1·42–1·52,

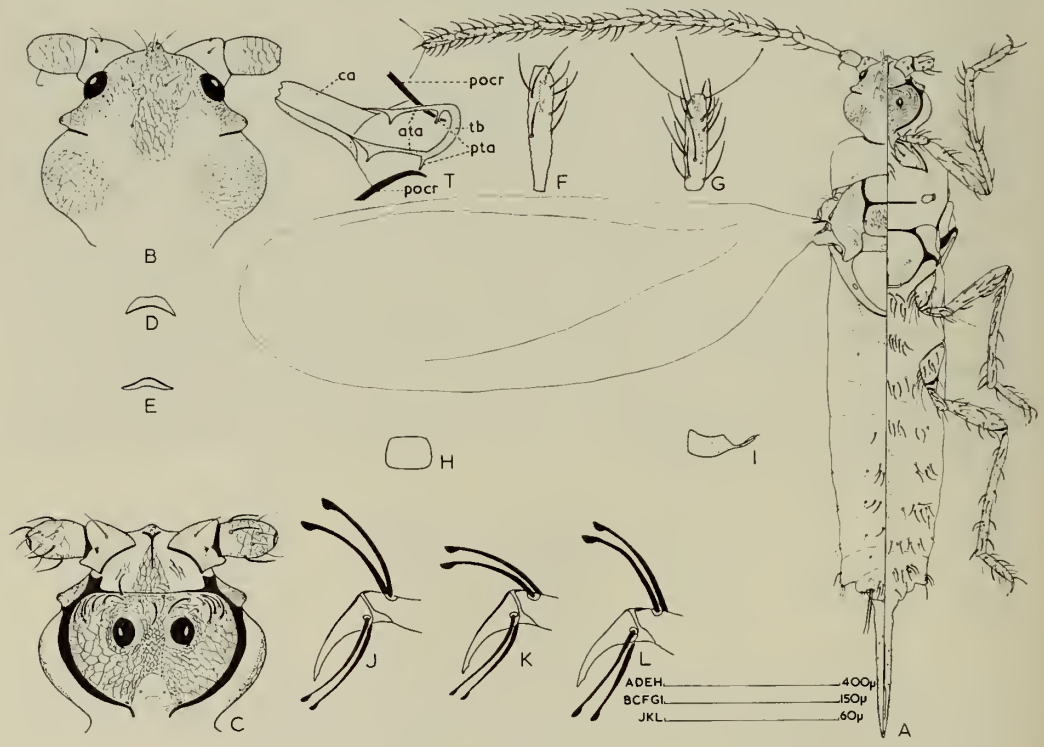


Fig. 24. *Eriopeltis* sp., dorsal and ventral view.

average 1·46) and longer than penial sheath (ratio 1 : 3·04–3·86, average 3·39). *Scape* 44–53 (average 48) μ long and 45–50 (average 46) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 49–61 (average 55) μ long and 34–42 (average 37) μ wide ; with 3–6 (average 4·2) f.s., 1–5 (average 2·9) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped with a rugose surface ; 4·0–4·9 (average 4·6) times longer than wide (99–125, average 114 μ long and 23–27, average 25 μ wide) ; with 5–11 (average 7·7) f.s. of medium length, 1·3–1·7 (average 1·5) times longer than width of segment ; with one or two usual sensilla basiconica. *Segments* IV–IX cylindrical, rugose ; lengths of these segments (in μ) 141–198 (average 162), 152–205 (average 171), 141–194 (average 159), 114–171 (average 135), 95–118 (average 106) and 84–95 (average 90) respectively, all of about the same width, varying from 19 to 23 μ ; with 14–23 (average 20), 20–30 (average 24), 19–28 (average 23), 14–23 (average 20), 14–20 (average 18) and 13–19 (average 16) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX not distinctly different from the f.s. *Segment* X : terminal part not constricted ; 80–95 (average 86) μ long and 19–21 (average 19) μ wide ; carrying 10–14 (average 11·5) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the three long ones are nearly half as long as the segment and the 2 short ones less than half as long as the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 448–486 (average 469) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, with an occasional fleshy *lateral pronotal seta* occurring immediately behind them. *Medial pronotal setae* and pores absent. *Post-tergites* very small, if present ; derm irregularly striated, without setae. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, usually narrowed medially ; median ridge only represented on anterior part of well sclerotized triangular sclerite. *Anteprosternal setae* absent ; *prosternal setae* : 1–7 (average 4·2) f.s., occurring medially around anterior part of the sternum.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 128 and 68 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially but not reticulated. *Scutum*. *Median membranous area* weakly polygonally reticulated ; subrectangular, 65–76 (average 73) μ long and 1·47–1·79 (average 1·62) times as wide (width 106–129, average 117 μ) ; with 4–10 (average 7) h.s. Anterior arms of scutum irregularly reticulated. *Scutellum* 38–46 (average 41) μ long and 114–137 (average 127) μ wide, ratio being 1 : 2·8–3·5 (average 3·1) ; tubular, with a small ventral foramen ; without setae. *Postnotum* with anterior margin irregular, weakly sclerotized and not overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* short, with shallow emargination. *Mesopleuron*. *Mesopleural ridge* strong, but becoming weaker immediately above coxal articulation ; *pleural apophysis* and *pleural wing* process well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* without polygonal reticulation ; *subepisternal ridge* becoming broader ventrally, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* very small. *Lateropleurite* partly bounded anteriorly by an exten-

FIG. 25. *Eriopeltis* sp., lateral view: also referable for lateral view of *E. festucae* (Fonsc.).

sion from marginal ridge. *Basisternum* large, about 176 μ wide and 130 μ long, i.e. 1·68–1·96 (average 1·79) times longer than membranous area of scutum ; median ridge reduced to a few vestiges of which the combined length is less than half the length of the basisternum ; *marginal* and *precoxal ridges* well developed ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular* setae absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 1–5 (average 2·8) h.s. *Third axillary wing sclerite* with small, rounded ventral projection at its base. *Additional sclerite* well sclerotized. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with posterior margin thickened throughout ; *suspensorial sclerites* absent. *Postnotum* consisting of a large, subtriangular sclerite on each side. *Metatergal setae* : usually one h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. *Episternum* reduced to a small subtriangular plate, *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 5–13 (average 9·1) f.s. and 0–2 (average 0·4) h.s. *Metasternal plate* transverse, irregular ; weak irregular sclerotization present in the area anterior to the sternum. *Anterior metasternal setae* : 14–23 (average 18) f.s. and 0–3 (average 0·6) h.s. ; *posterior metasternal setae* : 8–15 (average 11) f.s.

Wings hyaline ; long (1255–1340, average 1303 μ) and narrow (width 395–430, average 413 μ), ratio width to length being 1 : 3·02–3·29 (average 3·16) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and moderately slender, with fore legs usually longest and middle pair shortest ; ratio length of hind leg to body length is 1 : 1·96–2·09 (average 2·04). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	59–68	76–84	186–198	272–319	110–122	30–34	736–806
	(61)	(79)	(191)	(292)	(116)	(33)	(772)
II	57–67	72–80	175–198	270–315	103–114	28–31	711–789
	(60)	(75)	(183)	(291)	(109)	(29)	(748)
III	61–68	72–84	177–217	277–323	99–114	30–34	722–809
	(66)	(76)	(183)	(296)	(106)	(32)	(758)

Coxae with 6–9 (average 7·6), 10–13 (average 12) and 13–18 (average 16) f.s. on the fore, middle and hind coxa respectively, and each with 5–12 h.s. ; fore coxa without coxal bristles ; apical seta long, about as long as trochanter. *Trochanters* 25–30 μ wide ; with 6 oval sensilla, 5–10 f.s. and 7–10 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a very long apical seta which, on the fore trochanter, is 3·0–3·6 (average 3·3) times as long as the width of the trochanter. *Femora* of medium width (34–42 μ), ratio width to length of hind femur being 1 : 4·4–4·7 (average 4·6) ; with 14–22 (average 18) f.s. and 17–20 (average 19) h.s. on the fore, 10–18 (average 14) f.s. and 13–15 (average 14) h.s. on the middle, and 11–15 (average 12) f.s. and 11–17 (average 15) h.s. on the hind femur. *Tibiae* 19–23 μ wide, ratio width to length of hind tibia being 1 : 12·2–14·2 (average 13·2) ; each with 42–58 setae, of which 22–34 are h.s. and 17–33 f.s., the latter about 1½ times longer than width of tibia; apical spur about the same size on all tibiae. *Tarsus* 19–23 μ wide, hind tarsus 4·5–5·5 (average 4·9) times longer than wide ; each with 2–8 f.s. and 13–25 h.s. ; *tarsal digitules* subequal, somewhat longer than claw. *Claws* long, about 1½ times as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 520–600 (average 572) μ long and 240–300 (average 270) μ wide.

Segments I–VII : a small *tergite* occasionally present on each side on anterior margin of segment II ; *sternites* consisting of transverse plates on all segments, these usually less well sclerotized medially. *Caudal extension* of segment VII small, rounded, weakly sclerotized lateroventrally. *Dorsal setae* : 0–2 (average 0·4), 0–3 (average 1·1), 3–10 (average 6·3), 3–10 (average 5·9), 2–5 (average 3·2) and 0–4 (average 2·5) f.s. on segments II–VII respectively, and usually with one h.s. on each side on segments I and IV–VII. *Pleural setae* absent on segments

I–III and on IV–VI represented by h.s. only, which include the *dorsopleural setae* : usually one on IV and 2 on segments V–VI, and *ventropleural setae* : occasionally one on V and usually one on segment VI. Segment VII with 0–6 (average 2·8) f.s. and 5–7 (average 5·8) h.s., some of the posterior h.s. somewhat longer than rest. *Ventral setae* : segments II–VII with 10–18 (average 15), 7–16 (average 12), 7–13 (average 10), 7–14 (average 11), 7–12 (average 9) and 8–14 (average 11) f.s. respectively ; h.s. : none on II, usually one on each side of III–IV, and usually 4 (range 3–5) on each of segments V–VII.

Segment VIII with irregular tergite and transverse sternite, the latter carrying 0–2 (average 1·3) f.s. ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 4–6 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : 4–9 (average 5·8) f.s. and an occasional h.s. Posterior margin with 3–4 (average 3·1) h.s. on each side.

Genital segment. Penial sheath of medium length, about $\frac{2}{3}$–$\frac{1}{2}$ total body length (ratio 1 : 4·5–4·9, average 4·7), 314–342 (average 332) μ long and 29–36 (average 32) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; *basal rod* about $1\frac{1}{2}$ times as long as aedeagus, extending anteriorly from base of aedeagus to between $\frac{1}{2}$ and $\frac{3}{4}$ of the length from base of the latter to apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 27–37 (average 32) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (68–80, average 75 μ long), penial sheath and basisternum longer, the ratios being 1 : 4·1–4·9 (average 4·5) and 1 : 1·57–1·94 (average 1·74) respectively.

Material examined : 10 specimens, bred in the laboratory from material collected by myself on leaves of *Agrostis tenuis* Sibth. at the Imperial College Field Station, Silwood Park, Sunninghill, Berks. ; males emerged during September, 1962 ; the species was found to be bivoltine in the field.

Eriopeltis ?festucae (Fonscolombe)

(Text-figs. 26 and 25)

Living specimens light reddish brown ; short, slender, with comparatively long antennae and short legs ; with many setae on body and appendages. When mounted, total body length 1360–1570 (average 1486) μ ; width at mesothorax 280–310 (average 293) μ. Wing expanse 2730–2920 (average 2820) μ.

Head subconical in dorsal view ; in lateral view flat, not obliquely elongated dorsoventrally, anterodorsal bulge not pronounced ; length from apex to pronotal ridge 175–201 (average 190) μ, width across genae 182–201 (average 195) μ. *Median crest* sclerotized, distinctly polygonally reticulated, with 6–9 (average 7·8) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent; ventrally reduced to a shorter or longer median bar without lateral arms, surrounding area sclerotized and showing distinct polygonal reticulation. *Genae* large, weakly sclerotized, with distinct polygonal reticulation ; without setae. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 17–23 (average 20) μ in diameter and 3·3–4·2 (average 3·7) times as much apart ; those of the ventral eyes 19–23 (average 21) μ in diameter and 1·5–1·9 (average 1·7) times as much apart. *Ocellus* small, situated on a distinct protuberance which overhangs the postocular ridge. *Ocular sclerite* well sclerotized, distinctly polygonally reticulated throughout. *Preocular ridge* long, the ridges of each side ventrally meeting or almost meeting each other medially. *Postocular ridge* well developed and distinct throughout. *Interocular ridge* broadly joining pre- and postocular ridges below ocellus. *Dorsal ocular setae* absent. *Ventral head setae* : 12–25 (average 18) f.s. and 7–17 (average 12) h.s., arranged in a broad band on anterior part of the ocular sclerite, usually also with some (0–2, average 1) f.s. and some (0–3, average 1) h.s. occurring in the area anterior to this sclerite, but with none between the eyes. *Preoral ridge* absent.

Tendon-like apodeme absent or very short. *Cranial apophysis* of medium length ; apex truncate or rounded, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* present, situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 996–1060 (average 1018) μ long, i.e. longer than half body length (ratio 1 : 1·37–1·52, average 1·45), longer than posterior leg (ratio 1 : 1·38–1·45, average 1·41) and longer than penial sheath (ratio 1 : 3·31–3·49, average 3·41). *Scape* 42–49 (average 47) μ long and 44–48 (average 46) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 49–69 (average 57) μ long and 38–42 (average 39) μ wide ; with 2–5 (average 3·4) f.s., 3–7 (average 4·9) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, with a rugose surface ; 4·3–6·0 (average 5) times longer than wide (99–118, average 113 μ long and 19–25, average 22 μ wide) ; with 3–9 (average 5·4) f.s. of medium length, 1·2–1·7 (average 1·4) times longer than width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical, rugose ; lengths of these segments (in μ) 137–156 (average 148), 133–156 (average 145), 133–163 (average 146), 103–118 (average 111), 84–99 (average 90) and 72–87 (average 82) respectively, all of about the same width, varying from 19 to 23 μ and with 13–21 (average 18), 19–23 (average 21), 20–32 (average 26), 18–27 (average 22), 13–25 (average 18) and 11–17 (average 15) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX not markedly different from f.s. *Segment* X : terminal part not constricted ; 72–89 (average 80) μ long and 19–22 (average 20) μ wide ; carrying 6–12 (average 9·1) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about ¾ as long as the segment and the 2 short ones about half as long as the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 448–502 (average 473) μ long.

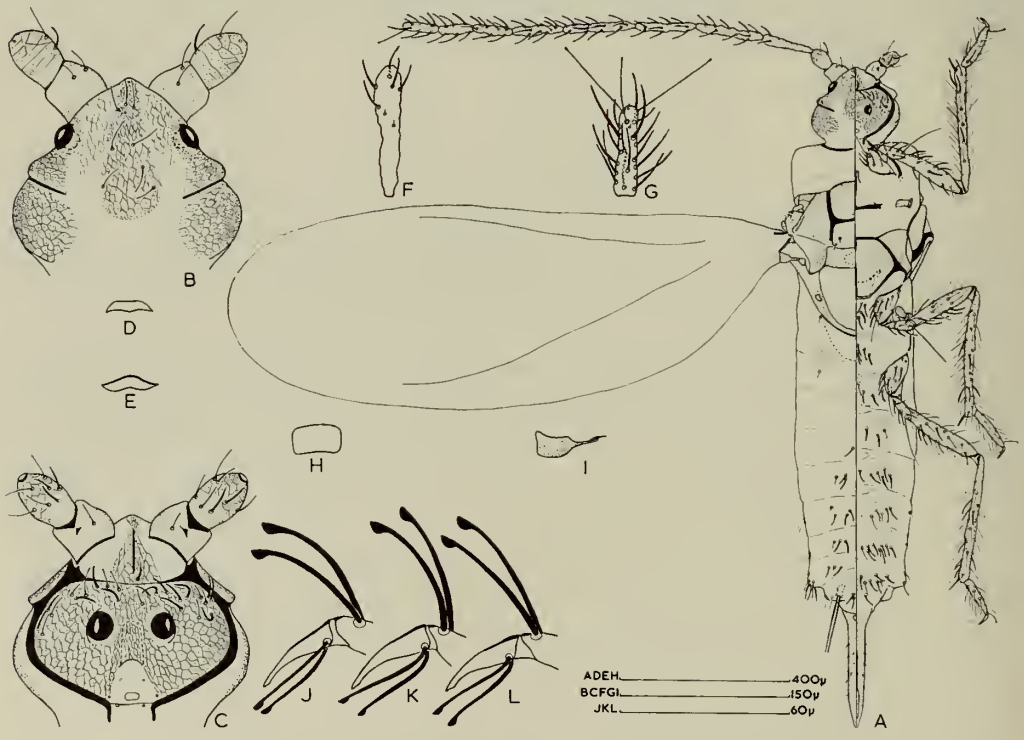


FIG. 26. *Eriopeltis ?festucae* (Fonsc.), dorsal and ventral view.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, with an occasional f.s. occurring on or immediately behind them. *Medial pronotal setae* rarely present, pores absent. *Posttergites* small, without wavy striations and without setae. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, usually somewhat narrowed medially ; median ridge sometimes complete but usually interrupted ; triangular sclerite well sclerotized. *Anteprosternal setae* absent ; *prosternal setae* consisting of 0–2 (average 0·7) f.s. occurring medially around anterior part of sternum.

Mesothorax. *Mesoprephragma* without emargination. *Prescutum* about 1½ times as wide as long (average 125 and 81 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially but not reticulated. *Scutum*. *Median membranous area* without reticulation ; subrectangular, 61–72 (average 64) μ long and 1·47–2·00 (average 1·71) times as wide (width 99–122, average 109 μ) ; with 2–10 (average 6) h.s. Anterior arms of scutum not reticulated. *Scutellum* 42–49 (average 45) μ long and 114–129 (average 122) μ wide, the ratio being 1 : 2·5–3·0 (average 2·7) ; tubular, with ventral foramen of medium size ; setae absent. *Postnotum* with the anterior margin irregular, weakly sclerotized and not overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with shallow emargination. *Mesopleuron*. *Mesopleural ridge* strong, but becoming weaker immediately above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* without polygonal reticulation ; *subepisternal ridge* becoming broader ventrally, but below the membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* very small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 171 μ wide and 128 μ long, i.e. 1·74–2·19 (average 2·01) times longer than membranous area of scutum ; median ridge sometimes complete but usually interrupted, the combined length of the vestiges more than half the length of the basisternum ; *marginal* and *precoxal ridges* well developed ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, its membranous bulge with a small weak sclerite posteriorly and with 2–6 (average 3·6) h.s. *Third axillary wing sclerite* with small, rounded ventral projection at its base. *Additional sclerite* well sclerotized. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with posterior margin thick and well developed throughout ; suspensorial sclerites absent ; a small sclerite sometimes present on each side anterior to postnotum. *Postnotum* consisting of a large, subtriangular sclerite on each side. *Metatergal setae* : one h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* : 8–11 (average 9·2) f.s. and 0–1 (average 0·3) h.s. *Metasternal plate* transverse, irregular ; no sclerotization present in the area anterior to sternum. *Anterior* and *posterior metasternal setae* : 8–17 (average 13) and 7–15 (average 10) f.s. respectively.

Wings hyaline; long (1240–1320, average 1280 μ) and narrow (width 400–460, average 422 μ), the ratio being 1 : 2·87–3·15 (average 3·04) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and moderately slender, with fore legs the longest and either middle or hind legs shortest ; ratio length of hind leg to body length is 1 : 1·98–2·12 (average 2·05). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	53–68	76–84	186–194	258–293	110–125	29–34	726–775
	(62)	(80)	(190)	(277)	(114)	(32)	(754)
II	61–68	72–80	171–190	251–274	106–122	27–32	695–751
	(62)	(76)	(180)	(262)	(111)	(29)	(720)
III	61–68	72–78	167–186	251–274	99–108	30–32	686–731
	(64)	(75)	(177)	(265)	(104)	(31)	(714)

Coxae each with 7–15 f.s. and 9–15 h.s. ; fore coxa without coxal bristles ; apical seta long, about as long as trochanter. *Trochanters* 26–30 μ wide ; with 6 oval sensilla, 5–12 f.s. and 7–11 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and one long apical seta which, on the fore trochanter, is 3·1–5·0 (average 4·1) times as long as width of trochanter. *Femora* of medium width (34–42 μ), ratio width to length of hind femur being 1 : 4·0–4·9 (average 4·6), each with 6–14 f.s. and 14–32 h.s. *Tibiae* 21–25 μ wide, ratio width to length of hind tibia being 1 : 10·3–13·1 (average 11·6) ; each with 48–62 setae, of which 30–52 are h.s. and 9–18 f.s., the latter about 1½ times as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 19–23 μ wide, hind tarsus 4·3–4·8 (average 4·6) times longer than wide ; each with 0–3 f.s. and 21–30 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* long, about 1½ times as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 470–600 (average 563) μ long and 250–300 (average 272) μ wide.

Segments I–VII : *tergites* absent ; *sternites* consisting of transverse plates on all segments, these usually less well sclerotized medially. *Caudal extension* of segment VII small, rounded and weakly sclerotized lateroventrally. *Dorsal setae* : 0–3 (average 0·8), 0–6 (average 2·5), 7–16 (average 9·7), 3–8 (average 4·9), 2–6 (average 3·4) and 2–6 (average 3·6) f.s. on segments II–VII respectively, and usually with one h.s. on each side on segments I and IV–VII. *Pleural setae* absent on segments I–III, and on IV–VI represented by h.s. only, which include *dorsopleural setae* : sometimes one on IV and usually 2 on segments V–VI, and *ventropleural setae* : usually one on each of segments V and VI. Segment VII with 1–8 (average 3·6) f.s. and 3–6 (average 4·8) h.s., some of the posterior h.s. somewhat longer than rest. *Ventral setae* : segments II to VII with 8–22 (average 14), 6–21 (average 13), 8–18 (average 11), 6–15 (average 12), 9–14 (average 12) and 8–15 (average 13) f.s. repectively ; h.s. ; none on II, sometimes one on each side on III and IV, and usually 4 (4–5) on each of segments V–VII.

Segment VIII with irregular tergite and transverse sternite, the latter carrying 0–3 (average 1·4) f.s. ; caudal extension forming a small, simple lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 4–6 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : 1–4 (average 2·7) f.s. and occasionally one short or long h.s. Posterior margin with 3 h.s. on each side.

Genital segment. Penial sheath of medium length, about ⅕ total body length (ratio 1 : 4·53–5·16 (average 4·95), 289–308 (average 300) μ long and 30–36 (average 34) μ wide, lateral sclerotizations narrowly joined anterior to anus ; *basal rod* 1½–2 times as long as aedeagus, extending anteriorly from the base of the latter for ½–¾ of the distance to the apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of the sheath to tip of aedeagus with 25–36 (average 30) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (61–69, average 65μ long), penial sheath and basisternum longer, ratios being 1 : 4·3–5·1 (average 4·7) and 1 : 1·78–2·19 (average 1·99) respectively.

Material examined : 10 specimens, bred in the laboratory from material collected by myself on leaves of *Festuca rubra* L. at the Imperial College Field Station, Silwood Park, Sunninghill, Berks. ; males emerged during September, 1963 ; the species was found to be bivoltine in the field.

This species can readily be separated from *Eriopeltis* sp. by the truncate or rounded apex of the cranial apophysis, the absence of the lateral arms of the midcranial ridge and the better developed median ridge of the mesosternum. In addition the post-tergital region, and the anterior arms and membranous area of the mesoscutum are not reticulated.

LUZULASPIS

Luzulaspis luzulae (Dufour)

(Text-figs. 27 and 28)

Living specimens light reddish brown ; short, slender, with comparatively long antennae and short legs ; with many setae on the body and appendages. When mounted, total body length 1020–1290 (average 1141) μ ; width at mesothorax 240–270 (average 255) μ. Wing expanse 2090–2350 (average 2213) μ.

Head subconical in dorsal view ; in lateral view flat, not obliquely elongated dorsoventrally, anterodorsal bulge not pronounced ; length from apex to pronotal ridge 148–179 (average 164) μ, width across genae 167–182 (average 175) μ. *Median crest* sclerotized, distinctly polygonally reticulated, with 7–10 (average 8·7) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally reduced to a shorter or longer median bar with lateral arms, surrounding area not sclerotized, but showing distinct polygonal reticulation. *Genae* large, weakly sclerotized, with distinct polygonal reticulation ; without setae. *Eyes* : two pairs, small, subequal; corneae of dorsal eyes 14–17 (average 15) μ in diameter and 4·0–4·5 (average 4·2) times as much apart ; those of the ventral eyes 15–20 (average 16) μ in diameter and 2·2–2·5 (average 2·3) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized, distinctly polygonally reticulated throughout. *Preocular ridge* long, the ridges of each side ventrally meeting or almost meeting each other medially. *Postocular ridge* well developed, but tapering dorsally. *Interocular ridge* broadly joining pre- and postocular ridges below ocellus. *Dorsal ocular setae* absent. *Ventral head setae* : 11–30 (average 25) f.s. and 6–16 (average 10) h.s., arranged in a broad band on anterior part of ocular sclerite, frequently with some (0–6, average 2·6) f.s. occurring in the area anterior to the sclerite and occasionally with a seta just behind anterior level of eyes ; a pair of median h.s. in the middle of the band distinctly longer than the rest.

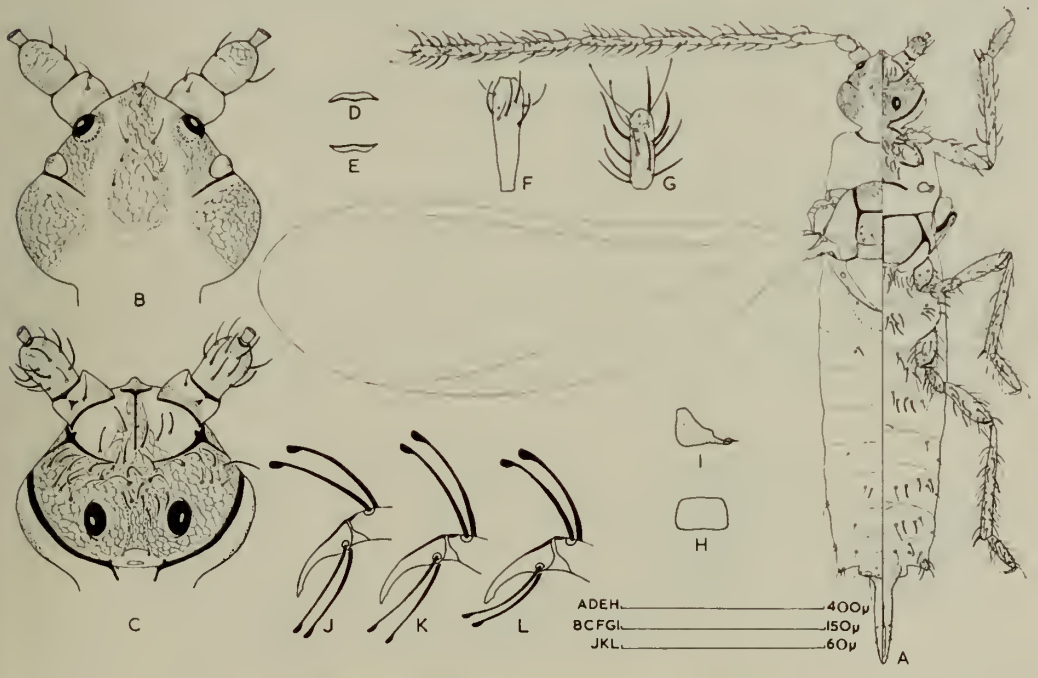


Fig. 27. *Luzulaspis luzulae* (Dufour), dorsal and ventral view.

Preoral ridge absent. *Tendon-like apodeme* short. *Cranial apophysis* long ; apex truncate, occasionally bifurcate, extending to around the level of the anterior margin of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* present, situated anterolateral to mouth opening.

Antennae 10-segmented, filiform ; 729–901 (average 822) μ long, i.e. longer than half body length (ratio 1 : 1·28–1·56, average 1·39), longer than posterior leg (ratio 1 : 1·36–1·40, average 1·38) and longer than penial sheath (ratio 1 : 4·36–6·02, average 4·87). *Scape* 36–46 (average 41) μ long and 36–40 (average 38) μ wide, with 3 h.s. and occasionally one f.s. *Pedicel* with weak, polygonal, dorsal reticulation ; 42–49 (average 45) μ long and 31–34 (average 33) μ wide; with 5–10 f.s., 1–5 (average 3·6) h.s., and a sensillum placodeum. *Segment* III somewhat club-shaped, 3·0–3·7 (average 3·3) times longer than wide (68–84, average 75 μ long and 23 μ wide); with 0–2 (average 0·7) h.s. and 1–6 (average 3·3) f.s., the latter of medium length, 1·2–1·6 (average 1·4) times longer than width of segment ; with 1 or 2 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 114–158 (average 131), 105–137 (average 122), 95–137 (average 118), 82–106 (average 97), 67–82 (average 74) and 57–72 (average 63) respectively, widths varying from 15 to 23 μ, with segment IX somewhat wider than proximal ones ; with 11–24 (average 18), 13–25 (average 20), 20–30 (average 23), 18–28 (average 22), 13–19 (average 16) and 12–20 (average 16) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII and IX not always distinctly different from f.s. *Segment* X : terminal part not constricted ; 46–61 (average 54) μ long and 19–23 (average 20) μ wide ; carrying 4–14 (average 8) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about ¾ as long as the segment and the 2 short ones shorter than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 357–424 (average 387) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* and pores absent. *Post-tergites* small, weakly sclerotized, with irregular wavy strictions, without setae. *Pleural structures* typical of family. *Sternum* with transverse ridge narrowed medially, median ridge represented by a short basal stalk, and triangular sclerite weakly sclerotized, with lines arching latero-anteriorly from basal stalk ; a small apophysis sometimes present anterior to this sclerite. *Anteprosternal setae* frequently absent, but sometimes up to 2 present on each side ; *prosternal setae* : 0–25 (average 14), but usually 12–21 f.s. and 0–1 (average 0·5) h.s., none of these occurring anterior to spiracles.

Mesothorax. *Mesoprephragma* short, with shallow emargination. *Prescutum* about twice as wide as long (average 116 and 60 μ respectively) ; anterior margin curved ; laterally bounded by strong *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially ; polygonally reticulated. *Scutum*. *Median membranous area* subrectangular ; 49–72 (average 60) μ long and 1·42–1·92 (average 1·70) times as wide (width 97–114, average 102 μ) ; with 3–8 (average 4·7) h.s. Anterior arms of scutum irregularly reticulated. *Scutellum* 29–34 (average 32) μ long and 95–114 (average 102) μ wide, ratio being 1 : 3·0–3·8 (average 3·4) ; tubular, with small ventral foramen ; usually without setae. *Postnotum* with

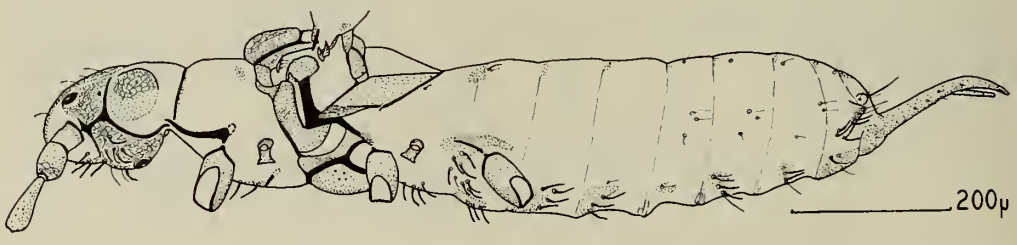


FIG. 28. *Luzulaspis luzulae* (Dufour), lateral view.

anterior margin irregular, weakly sclerotized, and partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* short, with shallow emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* without polygonal reticulation ; *subepisternal ridge* broadening ventrally, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* very small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 163 μ wide and 91 μ long, i.e. 1·26–1·72 (average 1·52) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* absent. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 1–5 (average 2·8) h.s. *Third axillary wing sclerite* with a small, rounded ventral projection at its base. *Additional sclerite* weak, but distinct. *Antemetaspiracular setae* absent.

Metathorax. *Metanotum* with posterior margin thickened throughout ; *suspensorial sclerite* absent. *Postnotum* large, transverse, weak or interrupted medially. *Metatergal setae* : one h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* absent. *Postmetaspiracular setae* 6–14 (average 10) f.s. and 0–2 (average 0·7) h.s. *Metasternal plate* weak, but more heavily sclerotized around anterior margin. *Anterior metasternal setae* : 16–23 (average 19) f.s. and no h.s. ; *posterior metasternal setae* : 7–19 (average 13) f.s.

Wings hyaline ; long (910–1050, average 969 μ) and narrow (295–360, average 336 μ wide), ratio width to length being 1 : 2·80–3·01 (average 2·90) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and moderately slender, all 3 pairs subequal in size, fore legs being only slightly shorter ; ratio length of hind leg to body length is 1 : 1·89–2·01 (average 1·98). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	43–57	61–70	125–152	186–217	76–91	26–28	518–599
	(49)	(65)	(140)	(203)	(82)	(27)	(566)
II	49–60	62–72	129–148	186–219	84–89	26–28	540–616
	(54)	(69)	(139)	(206)	(86)	(27)	(578)
III	46–57	61–68	125–152	190–224	80–87	25–27	536–613
	(52)	(65)	(140)	(209)	(84)	(26)	(577)

Coxae each with 10–17 f.s. and 10–18 h.s. ; fore coxa without coxal bristles ; apical seta long, about as long as trochanter. *Trochanters* 21–24 μ wide ; with 6 oval sensilla, 7–12 (average 9) f.s. and 7–9 (average 7·6) h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·7–2·2 (average 1·9) times as long as width of trochanter. *Femora* of medium width (30–32) μ, ratio width to length of hind femur being 1 : 4·1–5·0 (average 4·6) ; each with 8–16 f.s. and 9–17 h.s. *Tibiae* 17–23 μ wide, ratio width to length of hind tibia being 1 : 9·1–11·6 (average 10·5) ; each with 20–39 h.s. and 8–22 f.s., the latter about 1½ times longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 19–21 μ wide, hind tarsus 4·0–4·3 (average 4·2) times longer than wide ; each with 2–6 f.s. and 17–23 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* distinctly longer than width of tarsus, slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 350–505 (average 430) μ long and 200–260 (average 227) μ wide.

Segments I–VII : *tergites* represented by a weak sclerite on or near anterior margin of each segment ; *sternites* consisting of a weak transverse sclerite on segments II–III, a small sclerite on each side of V and VI, and a transverse plate on segment VII. *Caudal extension* of segment

VII small, rounded and weakly sclerotized latero-ventrally. *Dorsal setae* : f.s. occasionally present on segments I (0–2, average 0·6) and V–VII (up to 3) ; usually one h.s. on I and each of segments IV–VII. *Pleural setae* : absent on segments I, II and usually III, on segments IV–VI consisting of *dorsopleural setae* : usually 2 h.s. on each of segments IV–VI, and *ventropleural setae* : usually one h.s. and occasionally one f.s. on segments V–VI. Segment VII with 4–11 (average 8) f.s. and 3–5 (average 4) h.s., some of the posterior h.s. somewhat longer than rest. *Ventral setae* : 3–14 (average 9), 3–14 (average 9), 0–9 (average 3·7), 0–7 (average 2·6), 0–6 (average 3·3) and 1–9 (average 4·9) f.s. respectively ; h.s. : none on II, usually one on each side on III and IV, and usually 4 on each of segments V–VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a small, simple lobe ; *glandular pouch* absent, replaced by a shallow depression and one long pointed seta. No IXth tergite observed. *Ante-anal setae* absent, but 2–6 (average 3·9) small, circular pores present. Posterior margin with 2–4 (average 3) h.s. on each side, one of these situated more laterally on caudal extension.

Genital segment. Penial sheath short, about $\frac{1}{6}$ to $\frac{1}{7}$ total body length (ratio 1 : 6·1–7·3, average 6·7), 152–186 (average 173) μ long and 30–38 (average 34) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; *basal rod* about as long as aedeagus, extending anteriorly from base of aedeagus to between $\frac{1}{2}$ and $\frac{3}{4}$ of the distance to apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 18–26 (average 22) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (40–53, average 46 μ long), penial sheath and basisternum longer, the ratios being 1 : 3·2–4·3 (average 3·8) and 1 : 1·57–2·29 (average 1·97) respectively.

Material examined : 10 specimens, bred in the laboratory from material collected by myself on *Luzula campestris* (L.) at the Imperial College Field Station, Silwood Park, Sunninghill, Berks. ; males emerged during May, 1962 ; the species was found to be bivoltine in the field.

The *INGLISIA* Group

INGLISIA

Inglisia theobromae Newstead

(Text-figs. 29 and 30)

A medium-sized and moderately robust species, with comparatively long antennae and moderately long legs ; with numerous setae on the body and appendages. When mounted, total body length 1610–1790 (average 1710) μ ; width at mesothorax 370–420 (average 399) μ. Wing expanse 2870–3270 (average 3032) μ.

Head subconical in dorsal view ; in lateral view obliquely elongated, with the anterodorsal bulge not pronounced ; length from apex to pronotal ridge 209–262 (average 245) μ, width across genae 251–277 (average 266) μ. *Median crest* well sclerotized, especially around the posterior margin, which is obtuse ; weakly polygonally reticulated ; with 4–11 (average 7·2) fleshy and 10–14 (average 13) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventral part with median bar reduced posteriorly, the lateral arms widely diverging, and the surrounding area weakly sclerotized and reticulated. *Genae* large, sclerotized, not reticulated ; each with 5–11 (average 7) fleshy and 0–4 (average 1·2) hair-like *genal setae*. *Eyes* : four pairs ; dorsal and ventral pairs large, subequal ; lateral pairs large, only slightly smaller than dorsal and ventral eyes, subequal ; corneae of dorsal eyes 32–37 (average 35) μ in diameter and 1·6–2·1 (average 1·8) times as much apart ; those of the ventral eyes 30–36 (average 34) μ in diameter and 0·6–0·8 (average 0·7) times as much apart. *Ocellus* small. *Ocular sclerite*

weakly sclerotized ; reticulated only dorsally and between and anterior to the ventral eyes. *Preocular ridge* with ventral part not extending far below articular process. *Postocular ridge* well developed throughout ; below ocellus the ridge splits up, completely enclosing the ocellus. *Interocular ridge* absent, apparently represented by a small posteriorly directed process below the articular process of the preocular ridge. *Dorsal ocular setae* : on each side 0–3 (average 1·7) f.s. and occasionally one h.s. ; *ventral head setae* : 18–27 (average 23) f.s. and 7–11 (average 9) h.s., of which 1–4 (average 2) f.s. and 0–3 (average 1·1) h.s. occur anteriorly, around the midcranial ridge, and 1–4 (average 3) f.s. and 0–2 (average 1) h.s. between and behind the ventral eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 903–1047 (average 986) μ long, i.e. longer than half body length (ratio 1 : 1·67–1·82, average 1·73), longer than posterior leg (ratio 1 : 1·07–1·13, average 1·10) and longer than penial sheath (ratio 1 : 2·53–2·78, average 2·66). *Scape* 46–53 (average 47) μ long and 49–53 (average 51) μ wide, with 3 h.s. *Pedicel* not reticulated ; 38–48 (average 43) μ long and 34–38 μ wide ; with 1–4 (average 2) f.s., 4–9 (average 6·3) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 3·6–4·5 (average 4) times longer than wide (103–110, average 107 μ long and 25–29, average 27 μ wide) ; with 1–4 (average 2·2) h.s. and 6–12 (average 10) f.s., the latter of medium width, 0·8–1·1 (average 0·9) times as long as width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 114–141 (average 127), 114–137 (average 127), 125–152 (average 138), 116–129 (average 120), 89–122 (average 105) and 76–95 (average 82) respectively, all of about the same

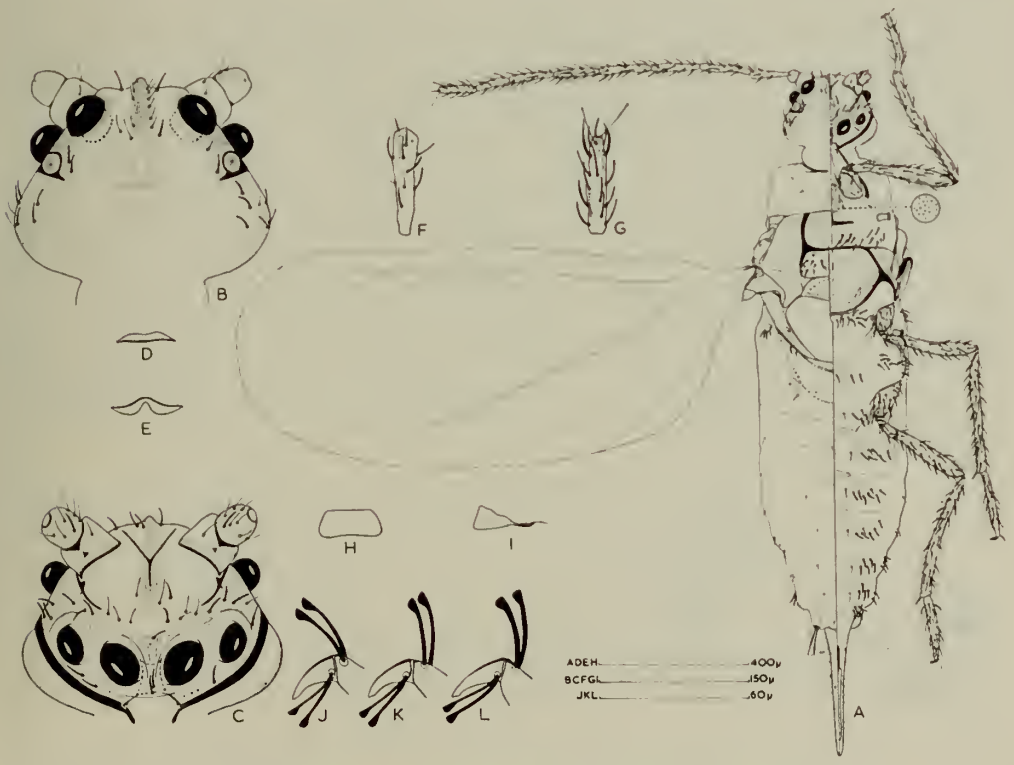


FIG. 29. *Inglisia theobromae* (Newst.), dorsal and ventral view.

width, varying from 17 to 25 μ ; with 22–25 (average 24), 22–30 (average 25), 22–34 (average 28), 20–28 (average 24), 17–27 (average 21) and 15–21 (average 17) f.s., respectively, and occasionally each with one or two h.s. ; *antennal bristles* on segments VIII–IX distinctly thicker than f.s. *Segment* X : terminal part not constricted ; 76–97 (average 90) μ long and 42–46 (average 43) μ wide ; carrying 9–16 (average 13) f.s., 2 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are less than half as long as the segment and the 2 shorter ones not distinctly different from the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 562–635 (average 600) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : occasionally one or two h.s. *Post-tergites* very small, without striations and without setae. *Pleural structures* typical of the family. *Sternum* with transverse ridge strong, median ridge reduced to a short basal stalk and triangular sclerite bearing numerous small projections. *Anteprosternal setae* absent ; *prosternal setae* : 5–11 (average 7·8) f.s. and 0–2 (average 0·9) h.s., the setae not occurring in front of spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about twice as wide as long (average 171 and 90 μ respectively) ; anterior margin almost straight ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially but not reticulated. *Scutum*. *Median membranous area* subrectangular ; 61–80 (average 70) μ long and 2·10–2·88 (average 2·51) times as wide (width 156–179, average 171 μ); with 3–15 (average 6·6) f.s. and 7–15 (average 12) h.s. *Scutellum* 53–80 (average 70) μ long and 144–175 (average 163) μ wide, the ratio being 1 : 2·1–2·9 (average 2·4) ; not tubular. *Postnotum* with anterior margin irregular and usually partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed, the latter connected with episternum by a narrow *basalare*. *Subalare* small. *Episternum* not reticulated; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bound anteriorly by an extension from marginal ridge. *Basisternum* large, about 253 μ wide and 162 μ long, i.e. 2·00–2·63 (average 2·33) times longer than membranous area of scutum ; median ridge almost completely absent, represented by somewhat darker sclerotization medially which sometimes appears ridge-like over short distances ; bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* : 20–28 (average 24) f.s. and 0–3 (average 1) h.s., arranged in a band behind the spiracles and prosternum. *Tegula* small, membranous bulge with a weak sclerite posteriorly, with 2–6 (average 4·2) h.s. and occasionally one f.s. *Third axillary wing sclerite* with a small ventral projection at its base. *Additional sclerite* well defined. *Antemetaspiracular setae* : 1–6 (average 3·8) f.s.

Fig. 30. *Inglisia theobromae* (Newst.), lateral view.

Metathorax. *Metanotum* with anterior margin strong medially ; *suspensorial sclerites* absent ; a small, additional sclerite occasionally present anterior to postnotum. *Postnotum* consisting of two narrow, transverse sclerites in a tandem alignment on each side. *Metatergal setae* : 0–2 (average 0·7) f.s. and 0–2 (average 0·8) h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 1–8 (average 3·6) f.s. and 0–2 (average 0·3) h.s. *Postmetaspiracular setae* : 6–11 (average 8·2) f.s. and 0–5 (average 1·7) h.s. *Metasternum* represented by a transverse plate. *Anterior metasternal setae* : 13–24 (average 19) f.s. and 0–3 h.s. *Posterior metasternal setae* : 5–16 (average 8·4) f.s.

Wings hyaline; of medium length (1270–1370, average 1333 μ) and width (540–580, average 561 μ), ratio width to length being 1 : 2·33–2·45 (average 2·38) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs moderately long and slender, with middle pair shortest and fore or hind pair longest ; ratio length of hind leg to body length is 1 : 1·87–1·98 (average 1·91). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57–61	68–84	224–255	308–369	133–164	20–25	821–952
	(60)	(80)	(239)	(339)	(148)	(22)	(888)
II	57–67	65–76	201–232	285–338	150–175	23–27	787–901
	(64)	(71)	(217)	(315)	(169)	(24)	(860)
III	61–72	76–84	201–232	304–357	160–179	25–29	827–937
	(67)	(79)	(219)	(333)	(173)	(26)	(896)

Coxae : inner surface of front coxa with small projections ; with 3–7 (average 5) f.s. on the fore and 14–21 on the middle and hind coxa, and each with 6–12 h.s. ; fore coxa without coxal bristles ; apical seta about ¾ as long as trochanter. *Trochanters* 23–29 μ wide ; with 6 oval sensilla, 7–15 f.s. and 6–9 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 2·0–2·4 (average 2·3) times as long as width of trochanter. *Femora* of medium width (36–44 μ), the ratio width to length of hind femur being 1 : 4·8–5·4 (average 5·2) ; each with 18–33 f.s. and 13–25 h.s. *Tibiae* 22–26 μ wide, ratio width to length of hind tibia being 1 : 12·9–15·7 (average 14) ; each with 64–99 setae of which 20–35 are h.s. and 39–68 f.s., the latter about as long as width of tibia ; apical spur on fore tibia short, about half as long as on the other tibiae. *Tarsi* 19–27 μ wide, hind tarsus 6·4–7·8 (average 7·2) times longer than wide ; each with 12–28 f.s. and as many h.s. ; *tarsal digitules* subequal, about as long as claw. *Claws* of medium length, about as long as width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 490–610 (average 558) μ long and 320–420 (average 380) μ wide.

Segments I–VII : *tergites* on segments II and III represented by 3 small sclerites on anterior margin—one medially and one on each side, and on segment IV by a small median sclerite. Pleurally a continuous band of sclerotization extends from segments IV–VII, with a separate small sclerite situated ventral to this band on each of segments IV–VII. *Sternites* on segments II–VII represented by a transverse plate, which is weak or interrupted medially. *Caudal extension* of segment VII small, rounded. *Dorsal setae* : sometimes one or two f.s. on segment I ; usually one h.s. on each side on I and each of segments V–VII, occasionally also a single h.s. on segments II–IV. *Pleural setae* consisting of *dorsopleural setae* : 0–3 (average 0·5), 0–2 (average 0·6) and 0–2 (average 0·8) f.s. on segments III and VI and 0–1 (average 0·7) 1, 1, 1–2 (average 1·2), 0–2 (average 1·3) and 1–3 (average 1·8) h.s. on segments I–VI respectively, and of *ventropleural setae* : 0–1 (average 0·4), 0–3 (average 1·5) and 0–5 (average 2·1) f.s. on segments IV–VI and 0–1 (average 0·4), 0–1 (average 0·5), 1–2 (average 1·2), 0–1 (average 0·9) and 1 h.s. on segments II–VI respectively. Segment VII with 3–9 (average 5·4) f.s. and 1–6 (average 3·7) h.s. *Ventral setae* : 2–15 f.s. on each of segments II–VII ; usually 4 h.s. on each of II–V, and 2 median ones on each of segments VI–VII.

Segment VIII with small tergite and transverse sternite, the latter carrying 7–15 (average 11) f.s. ; *glandular pouch* with 2 very long, pointed setae, whose protruding part is 4–6 times as long as section within pouch. No IXth tergite observed. *Ante-anal setae* : occasionally one or two f.s. and 0–4 (average 1·5) small h.s. present. Posterior margin with 2–3 (average 2·6) f.s. on each side.

Genital segment. Penial sheath of medium length, about $\frac{1}{5}$ total body length (ratio 1 : 4·30–4·86, average 4·60), 353–380 (average 371) μ long and 34–40 (average 37) μ wide ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about $\frac{2}{3}$ that of aedeagus and extending anteriorly from base of the aedeagus for $\frac{3}{5}$–$\frac{3}{4}$ of the distance to the apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 28–44 (average 35) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* long (350–380, average 371 μ), penial sheath longer and basisternum shorter, ratios being 1 : 1·9–2·1 (average 2) and 1 : 0·72–0·93 (average 0·85) respectively.

Material examined : 10 specimens, collected by G. De Lotto on *Pelargonium* sp. at Limuru, Kenya on 16.i.63.

A number of the peculiarities of this species are shared by *Ceroplastodes chiton* Green, of which 3 imperfect specimens were available. The most striking of these are : the presence of 4 large simple eyes, the numerous projections on the prosternum, the absence of the median ridge of the mesobasisternum, the presence of a pleural band of sclerotization on the abdomen and the presence of numerous f.s. (about 18 in *C. chiton*) on the 8th abdominal sternite. In addition, *C. chiton* also has f.s. on all the regions of the head and prothorax, on the membranous area of the mesoscutum and all the regions of the metathorax and abdomen ; the setae of the glandular pouch are also very long, the protruding part being about 4 times as long as the section within the pouch.

C. chiton differs from *I. theobromae* in the following respects : the midcranial ridge is reduced to a Y-shaped sclerotized area ventrally, and sometimes represented dorsally by a short median ridge on the posterior part of the median crest ; the postocular ridge is missing behind the ocellus ; a number of f.s. are situated beyond the posterolateral corners of the median membranous area ; the anterior margin of the mesopostnotum is exposed ; the tegular bulge carries a large number (more than 5) f.s. ; the postnotum is represented by a single transverse sclerite ; the presence of numerous (about 10) fleshy ante-anal setae ; the apical spur of the tibia is about the same size on all 3 tibiae.

The antennae of *C. chiton* were not available.

The specimens of *C. chiton* were collected by G. Charles on *Carica papaya* L. in Port Moresby, New Guinea on 23.vii.59, and received from D. J. Williams.

The *COCCUS* Group

COCCUS

Coccus hesperidum Linnaeus

(Text-figs. 31 and 32)

A short, slender species with comparatively short antennae and long legs ; with numerous setae covering the body and appendages. When mounted, total body length 1380–1520

(average 1450) μ ; width at mesothorax 280–330 (average 309) μ. Wing expanse 2200–2650 (average 2446) μ.

Head subconical in dorsal view ; in lateral view obliquely elongated, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 198–239 (average 216) μ, width across genae 186–205 (average 196) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with numerous fleshy *dorsal head setae* and 5–9 (average 6·8) hair-like ones. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. *Genae* large, sclerotized, with polygonal reticulation ; each with 19–29 (average 23) fleshy and 3–7 (average 4·9) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 21–32 (average 27) μ in diameter and 1·0–2·1 (average 1·3) times as much apart ; those of the ventral eyes 22–32 (average 29) μ in diameter and 0·6–1·6 (average 0·9) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized dorsally and laterally, but weak ventrally except for an area around the eyes ; polygonally reticulated throughout. *Preocular ridge* extending only a short distance below articular process. *Postocular ridge* well developed throughout ; dorsal and ventral to ocellus the ridge usually splits up, with the anterior branch partly surrounding ocellus. *Interocular ridge* absent, although the area between ocellus and preocular ridge is strongly sclerotized. *Dorsal ocular setae* : 2–8 (average 4·9) f.s. and 0–4 (average 1·6) h.s. on each side. *Ventral head setae* : 75–98 (average 83) f.s. and 3–4 (average 3·8) h.s., scattered over the ocular sclerite, always with some (9–14, average 12) f.s. occurring in front of this sclerite and with 8–16 (average

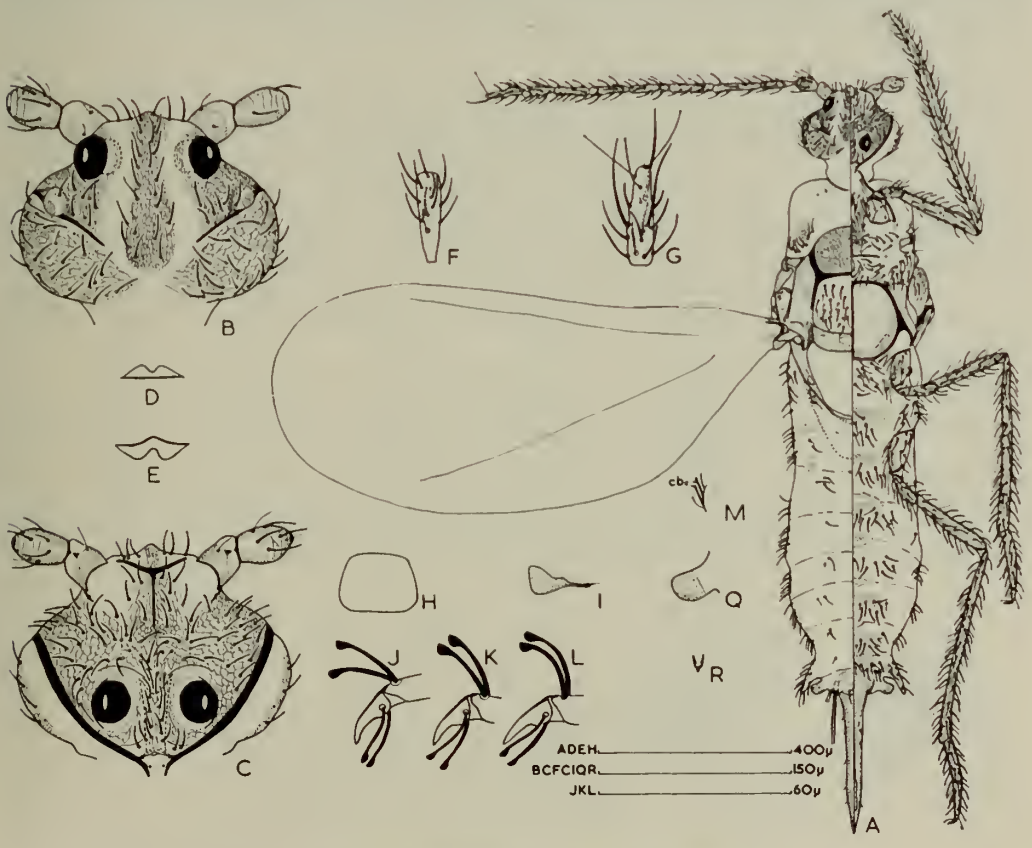


FIG. 31. *Coccus hesperidum* L., dorsal and ventral view.

12) f.s. between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long, *Cranial apophysis* long ; apex deeply bifurcate, extending to around anterior level of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 576–732 (average 663) μ long, i.e. shorter than half body length (ratio 1 : 2·01–2·63, average 2·26), shorter than posterior leg (ratio 1 : 0·58–0·74, average 0·69) and longer than penial sheath (ratio 1 : 2·10–2·43, average 2·27). *Scape* 38–46 (average 43) μ long and 27–31 (average 30) μ wide, with 3–4 (average 3·1) h.s. *Pedicel* with wavy striation dorsally ; 46–53 (average 50) μ long and 27–33 (average 31) μ wide ; with 6–13 (average 9·7) f.s., 2–7 (average 4·2) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 3·0–3·7 (average 3·3) times longer than wide (57–72, average 60 μ long and 19–21, average 20 μ wide) ; with 10–13 (average 11) f.s. of medium length, 1·3–1·8 (average 1·5) times longer than width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 84–103 (average 95), 68–91 (average 81), 49–76 (average 67), 68–84 (average 75), 53–76 (average 62) and 55–68 (average 60) respectively, widths varying from 15 to 21 μ, with distal segments slightly wider than proximal ones ; with 20–25 (average 22), 18–25 (average 22), 12–23 (average 18), 19–23 (average 20), 15–21 (average 18) and 13–20 (average 17) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal $\frac{1}{2}$–$\frac{1}{3}$ constricted ; 57–78 (average 69) μ long and 49–55 (average 52) μ wide (near base) ; carrying 6–9 (average 7·5) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about as long as the segment and the 2 short ones about half as long as the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 448–540 (average 516) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : 2 h.s., widely separated, with 0–1 (average 0·4) circular pores near each. *Post-tergites* relatively large, with irregular wavy striations and with 4–13 (average 8·3) fleshy *post-tergital setae* occurring onor be hind the sclerite on each side. *Pleural structures* typical of the family. *Sternum* with strong transverse and median ridges and a small oval sclerite ; the area on each side of the median ridge showing distinct polygonal reticulation. *Anteprosternal setae* : 1–4 (average 3·2) f.s. on each side ; *prosternal setae* : 29–37 (average 33) f.s., scattered over the sternal area and spreading into the area anterior to the spiracles, and usually with one h.s. (0–2, average 0·9) on each side of median ridge.

Mesothorax. *Mesoprephragma* with deep emargination. *Prescutum* about twice as wide as long (average 159 and 83 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially ; with dense irregular reticulation. *Scutum*. *Median membranous area* subrectangular, 99–125 (average 116) μ long and 1·23–1·37 (average 1·30) times as wide (width 135–160, average 146 μ) ; with 10–32 (average 24) f.s. and 11–15 (average 13) h.s. *Scutellum* 34–42 (average 38) μ long and 141–160 (average 154) μ wide, ratio being 1 : 3·8–4·2 (average 4) ; tubular, with a small ventral foramen ; setae absent. *Postnotum* with anterior margin weakly

FIG. 32. *Coccus hesperidum* L., lateral view.

sclerotized, irregular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and without setae. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subalare* small. *Episternum* showing irregular reticulation dorsally and polygonal reticulation ventrally ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. *Epimeron* small. *Lateropleurite* not bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 182 μ wide and 147 μ long, i.e. 1·20–1·35 (average 1·27) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 52–75 (average 61) f.s., arranged in a broad band behind the spiracles and prosternum, and with a few on the episternae. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 2–6 (average 4·2) h.s. *Third axillary wing sclerite* with a small, pointed, ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 3–4 (average 3·6) f.s.

Metathorax. *Metanotum* with posterior margin strong medially ; *suspensorial sclerites* absent. *Postnotum* consisting of a small sclerite on each side. *Metatergal setae* : 1–5 (average 3·1) f.s., and usually one (0–2, average 1) h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 10–18 (average 15) f.s. and occasionally one h.s. *Postmetaspiracular setae* : 8–14 (average 12) f.s. and usually one h.s. ; some f.s. occurring anterior to rest, close behind spiracles. *Metasternal plate* weak and irregular, but more heavily sclerotized anteriorly. *Anterior* and *posterior metasternal setae* : 39–54 (average 45) and 12–26 (average 19) f.s. respectively.

Wings hyaline; of medium length (980–1200, average 1097 μ), but comparatively broad (width 430–520, average 481 μ), ratio width to length being 1 : 2·19–2·31 (average 2·27) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs long and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·58–1·65 (average 1·62). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	38–49	57–72	171–200	291–369	117–152	17–18	692–850
	(46)	(66)	(190)	(341)	(136)	(17·5)	(795)
II	69–80	76–84	163–190	293–350	127–148	17–19	749–864
	(75)	(81)	(180)	(322)	(140)	(18)	(814)
III	76–84	76–87	178–203	342–395	141–160	19–20	834–943
	(81)	(84)	(191)	(369)	(152)	(19·5)	(895)

Coxae with 10–15 (average 12) f.s. on the fore and 16–29 on the middle and hind coxa, and each with 7–10 (average 7·8) h.s. ; fore coxa with 2–3 (average 2·3) capitate coxal bristles ; apical seta about $\frac{2}{3}$ as long as trochanter. *Trochanters* 19–23 μ wide ; with 6 oval sensilla, 9–15 f.s. and 5–7 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 1·2–1·4 (average 1·3) times as long as width of trochanter. *Femora* very slender, 27–34 μ wide, ratio width to length of hind femur being 1 : 6·1–6·7 (average 6·4) ; with 27–46 f.s. and 8–14 h.s. *Tibiae* 17–21 μ wide, ratio width to length of hind tibia being 1 : 18·0–20·8 (average 19·1) ; each with 89–114 setae of which 17–28 are h.s. and 89–114 f.s., the latter about twice as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 17–21 μ wide, hind tarsus 7·8–8·4 (average 8·2) times longer than wide ; with 24–42 f.s. and 13–23 h.s. ; *tarsal digitules* subequal, somewhat longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with very small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 400–490 (average 448) μ long and 230–290 (average 263) μ wide.

Segments I–VII : *tergites* present on segment II only, represented by 3 small sclerites on anterior margin, one medially and one on each side ; *sternites* represented by transverse plates on segments II, III and V–VII. *Caudal extension* of segment VII large, reaching or extending beyond the level of posterior margin of segment VIII, tapering, weakly sclerotized. *Dorsal setae* : up to 8, 7, 9, 7, 6 and 3 f.s. on segments I–VI respectively, but none on VII ; usually one h.s. on each side on segment I and each of segments IV–VII. *Pleural setae* consisting of *dorsopleural setae* : 4–12 (average 8·1), 2–7 (average 4·4), 6–9 (average 7·5), 5–9 (average 6·4), 3–8 (average 4·8) and 1–6 (average 3·9) f.s. on I–VI, and 0–1 (average 0·5), 0–3 (average 1·6), 1–3 (average 2·4), 2–4 (average 2·4) and 0–3 (average 1·6) h.s. on segments II–VI respectively, and of *ventropleural setae* (sometimes difficult to separate from dorsopleural group) : usually one f.s. on II–III and up to 5 on segments IV–VI, and usually one h.s. on segments IV–VI. Segment VII with 10–17 (average 14) f.s. and 4–6 (average 5·3) h.s. ; some of the posterior h.s. usually longer than rest. *Ventral setae* : 16–21 (average 17), 14–26 (average 20), 11–25 (average 16), 12–23 (average 16), 8–17 (average 11) and 5–12 (average 9) f.s. on segments II–VII respectively ; usually one h.s. on each side on segments III–IV and 4 on each of segments V–VII.

Segment VIII with a weak tergite and transverse sternite ; caudal extension forming a sclerotized cylindrical lobe with a large, weakly reticulated, membranous cicatrix posteriorly on the lobe ; *glandular pouch* with 2 long, pointed setae, whose protruding part is $4\frac{3}{4}$–6 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : usually 2 strong h.s. Posterior margin with 2–3 (average 2·9) h.s. on each side.

Genital segment. *Penial sheath* of medium length, about $\frac{1}{5}$ total body length (ratio 1 : 4·8–5·1, average 4·9), 274–308 (average 296) μ long and 30–34 (average 32) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about $1\frac{1}{2}$ times that of aedeagus and extending anteriorly from base of aedeagus for about $\frac{2}{3}$–$\frac{3}{4}$ of the distance to the apex of the basal membranous area ; apex of sheath with a small but distinct membranous extension. Area from base of sheath to tip of aedeagus with 15–23 (average 20) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (57–67, average 62 μ long), penial sheath and basisternum longer, ratios being 1 : 4·5–5·3 (average 4·8) and 1 : 2·12–2·80 (average 2·39) respectively.

Material examined : 9 specimens, 4 from *Laurus nobilis* L., collected inLeningrad, USSR, on 11.vi.60 and 5 from " citrus ", collected in Leningrad on 3. xi.61 ; both samples received from N. S. Borchsenius.

Genus *B.* sp. (near ***PULVINARIA***)

(Text-figs. 33 and 34)

A moderately long, slender species with comparatively short antennae and long legs ; with numerous setae covering the body and appendages. When mounted, total body length 1960–2100 (average 2044) μ ; width at mesothorax 3440–3560 (average 3515) μ. Wing expanse 3440–3560 (average 3515) μ.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 289–308 (average 301) μ, width across genae 353–385 (average 366) μ. *Median crest* sclerotized and distinctly polygonally reticulated; with numerous (10–22, average 16) fleshy *dorsal head setae* and 6–9 (average 7·1) hair-like ones. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. *Genae* large, sclerotized, with polygonal reticulation ; each with 12–24 (average 17) fleshy and 3–8 (average 4·6) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 27–30 (average 28) μ in diameter and 1·5–2·3 (average 1·9) times as much apart ; those of the ventral eyes 27–30 (average 29) μ in diameter and 1·0–1·8 (average 1·4) times as much apart. *Ocellus* small.

Ocular sclerite well sclerotized dorsally and laterally, but weak ventrally ; polygonally reticulated throughout. *Preocular ridge* extending only a very short distance below articular process. *Postocular ridge* well developed throughout ; below ocellus the ridge splits up with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 1–4 (average 2·3) f.s. and 1–4 (average 2·3) h.s. on each side. *Ventral head setae* : 45–78 (average 62) f.s. and 3–8 (average 5·4) h.s., scattered over the ocular sclerite, always with some (3–8, average 5·4) f.s. occurring in front of this sclerite and with 1–8 (average 4·8) between and behind the eyes (when present in small numbers situated well behind the level of the anterior margin of the eyes). *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* long ; apex deeply bifurcate, extending to around the level of the anterior margin of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 979–1094 (average 1028) μ long, i.e. about half body length (ratio 1 : 1·86–2·13, average 1·99), shorter than posterior leg (ratio 1 : 0·77–0·82, average 0·79) and longer than penial sheath (ratio 1 : 2·67–3·13, average 2·94). *Scape* 57–61 (average 60) μ long and 40–45 (average 42) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 65–72 (average 70) μ long and 40–45 (average 52) μ wide ; with 9–13 (average 12) f.s. 3–6 (average 4·7) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 2·6–3·1 (average 2·8) times longer than wide (68–84, average 78 μ long and 27–30, average 28 μ

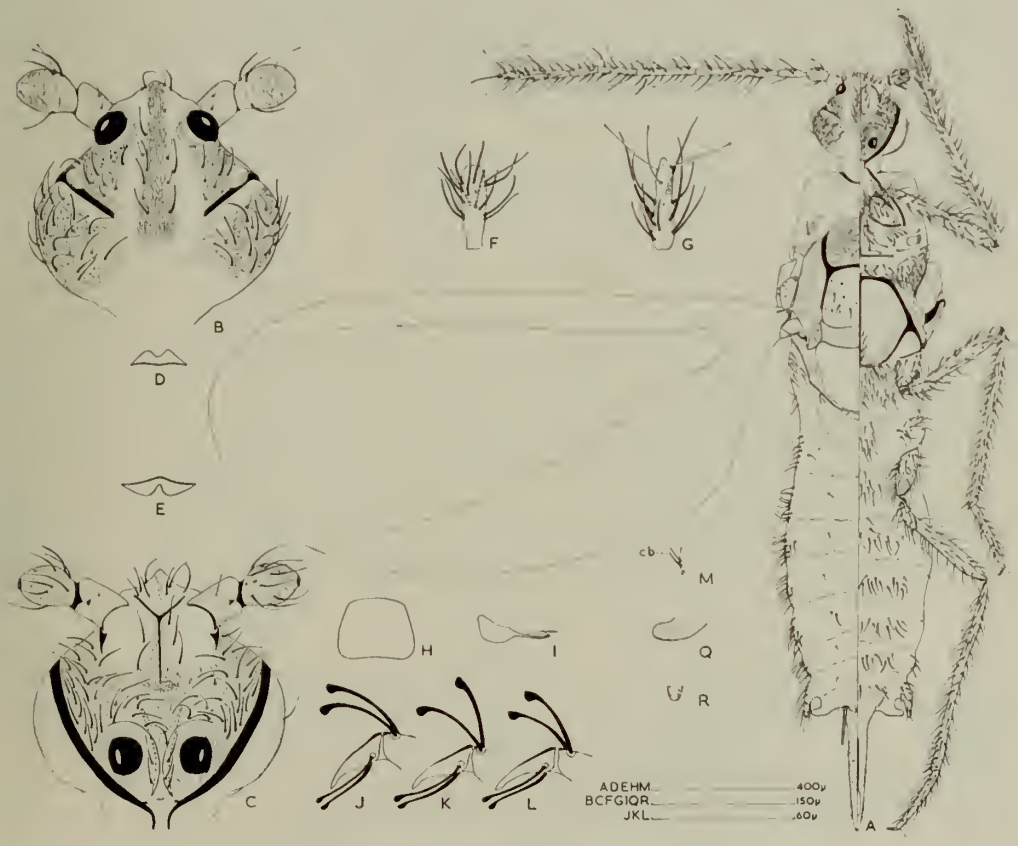


FIG. 33. Genus *B*, dorsal and ventral view.

wide) ; with 11–17 (average 13) f.s. of medium length, 1·6–2·3 (average 1·9) times longer than width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 205–228 (average 218), 137–171 (average 153), 98–129 (average 113), 95–118 (average 104), 72–91 (average 82) and 65–80 (average 73) respectively, widths varying from 21 to 27 μ, with distal segments slightly wider than proximal ones ; with 38–49 (average 42), 28–35 (average 32), 24–31 (average 27), 22–33 (average 26), 17–25 (average 21) and 15–19 (average 17) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal $\frac{1}{3}$ constricted ; 72–95 (average 81) μ long and 24–27 (average 25) μ wide (near base) ; carrying 4–8 (average 6·1) f.s., 3 capitate *subapical* setae and 5 *antennal bristles* of which the 3 long ones are about as long as segment and the 2 shorter ones about as long as f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 730–779 (average 755) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* medium-sized, without setae. *Medial pronotal setae* occasionally present, consisting of 0–2 (average 0·6) f.s. and 0–2 (average 0·6) h.s. ; 2–5 (average 3·6) circular pores present on each side posterior to pronotal sclerite. *Post-tergites* relatively large, with irregular wavy striation and usually with some (0–3, average 1·4) fleshy *post-tergital setae* on each side, occurring on or behind the sclerite. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, a strong but interrupted median ridge, and an oval-shaped sclerite. *Anteprosternal setae* : 1–3 (average 2·4) f.s. on each side ; *prosternal setae* : 15–28 (average 21) f.s., scattered over the sternal area and spreading into the area anterior to the spiracles, and usually one (0–2, average 1) h.s. on each side of median ridge.

Mesothorax. *Mesoprephragma* with deep emargination. *Prescutum* about $1\frac{3}{4}$ times as wide as long (average 219 and 121 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially ; with dense irregular reticulation. *Scutum*. *Median membranous area* subrectangular ; 152–169 (average 157) μ long and 1·40–1·53 (average 1·45) times as wide (width 213–243, average 227 μ) ; with 7–18 (average 11) f.s. and 14–22 (average 18) h.s. *Scutellum* 65–72 μ long and 220–247 (average 229) μ wide, the ratio being 1 : 3·1–3·8 (average 3·4) ; tubular, with small ventral foramen ; setae absent. *Postnotum* with anterior margin weakly sclerotized, and usually regular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and without setae. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subalare* small. *Episternum* showing irregular reticulation dorsally and polygonal reticulation ventrally ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* not bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 268 μ wide and 228 μ long, i.e. 1·39–1·53 (average 1·45) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; with 2–9 (average 5·4) f.s. posteriorly

FIG. 34. Genus *B*, lateral view.

on or near median ridge. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 50–87 (average 66) f.s., arranged in a broad band behind the spiracles and prosternum, often with a few on the episternae. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 2–6 (average 3·1) h.s. *Third axillary wing sclerite* with a small, pointed, ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 2–4 (average 3·1) f.s.

Metathorax. *Metanotum* with posterior margin usually strong medially ; *suspensorial sclerites* absent ; occasionally a small, additional sclerite present anterior to postnotum. *Postnotum* consisting of 2 small sclerites, one on each side. *Metatergal setae* : usually 2 h.s. on each side, one laterally and one more medially, and usually with one (0–3) f.s. near the lateral h.s. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 9–19 (average 13) f.s. and in one case 2 h.s. *Postmetaspiracular setae* : 14–23 (average 18) f.s. and usually one (0–2) h.s., one or more f.s. occurring anterior to rest, close behind spiracle. *Metasternal plate* weak and irregular, but more heavily sclerotized anteriorly. *Anterior metasternal setae* : 47–78 (average 63) f.s., occasionally one h.s. ; *posterior metasternal setae* : 18–41 (average 27) f.s.

Wings hyaline ; of medium length (1540–1600, average 1571 μ), but comparatively broad (720–780, average 763 μ wide), the ratio width to length being 1 : 2·03–2·14 (average 2·06) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs long and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·51–1·63 (average 1·56). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65–80	76–89	304–334	498–536	194–217	25–30	1180–1286
	(74)	(84)	(317)	(516)	(203)	(28)	(1221)
II	99–122	106–118	277–300	490–543	186–209	28–30	1203–1301
	(111)	(111)	(289)	(517)	(197)	(29)	(1253)
III	101–114	114–125	277–304	532–597	200–213	27–31	1277–1382
	(111)	(117)	(290)	(560)	(206)	(30)	(1314)

Coxae : 16–24 (average 19) f.s. on the fore and 26–34 on the middle and hind coxa, and each with 6–12 h.s. ; fore coxa with 2–4 (average 2·6) capitate coxal bristles ; apical seta about ¾ as long as trochanter. *Trochanters* 29–34 μ wide ; with 6 oval sensilla ; with 8–10 (average 9) f.s. on the fore and 14–20 on the middle and hind trochanter ; each with 6–8 h.s. which include 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·7–1·9 (average 1·8) times as long as width of trochanter. *Femora* slender, 42–49 μ wide, the ratio width to length of hind femur being 1 : 5·98–6·52 (average 6·24) ; with 35–49 f.s., and with 17–28 (average 22) h.s. on the fore and 10–18 on the middle and hind femur. *Tibiae* 23–27 μ wide ; ratio width to length of hind tibia being 1 : 20·6–22·4 (average 21·2) ; each with 105–141 setae of which 19–37 are h.s. and 80–107 f.s., the latter about twice as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 20–25 μ wide, hind tarsus 8·1–9·3 (average 9) times longer than wide ; each with 30–46 f.s. and 13–25 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* of medium length, somewhat longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 620–700 (average 676) μ long and 370–500 (average 405) μ wide.

Segments I–VII : *tergites* present on anterior margin of segments II–III, represented by 3 small sclerites—one medially and one on each side ; *sternites* represented by a transverse plate on segments II, III, V–VII. *Caudal extension* of segment VII large, reaching level of posterior margin of segment VIII, tapering, weakly sclerotized. *Dorsal setae* : usually a few (0–5, average 2·2) f.s. on the 1st and occasionally one or two on each of segments II–V ; usually one h.s. on each side on all segments. *Pleural setae* : consisting of *dorsopleural setae* : 5–16 (average

10), 4–9 (average 5·9), 4–11 (average 7·2), 4–11 (average 6·8) 2–9 (average 5) and 1–5 (average 2·6) f.s. on II–VI, and 0–1 (average 0·3), 1–3 (average 1·9), 2–4 (average 3·1), 2–4 (average 3·1) and 2–5 (average 3·2) h.s. on segments III–VI respectively, and of *ventropleural setae* : occasionally one or two f.s. on IV, 0–3 (average 1·5) on V and 0–5 (average 2·4) on the VI, with occasionally one h.s. on III and usually one on each of segments IV–VI. Segment VII with 10–16 (average 14) f.s. and 3–6 (average 4·7) h.s., some of the posterior h.s. usually longer than rest. *Ventral setae* : 17–26 (average 21), 18–28 (average 24), 10–21 (average 16), 9–15 (average 12), 4–10 (average 6·7) and 3–10 (average 6·2) f.s. on segments II–VII respectively ; usually one h.s. on each side on segments II–IV and 4 on each of V–VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a geniculate lobe, with a large, weakly reticulated, membranous cicatrix posteriorly ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2–2½ times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : usually 2 strong h.s., with occasionally one or two additional small h.s. and with 1–5 (average 2·5) small, circular pores. Posterior margin with 2–3 (average 2·8) h.s. on each side.

Genital segment. Penial sheath short, about $\frac{1}{6}$ total body length (ratio 1 : 5·6–6·1, average 5·9), 334–367 (average 352) μ long and 34–42 (average 38) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* 1¾–2 times that of aedeagus, extending anteriorly from the base of the aedeagus for about ¾ of the distance to the apex of the basal membranous area ; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 23–34 (average 28) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (57–72, average 67 μ long), penial sheath and basisternum longer, the ratios being 1 : 4·8–6·1 (average 5·3) and 1 : 3·11–3·93 (average 3·43) respectively.

Material examined : 10 specimens ; from leaves of unknown plant ; collected in Goba, Ethiopia on 6.viii.62 by members of Imperial College Expedition ; identification by K. Boratyński.

PULVINARIA

Pulvinaria ?betulae (Linnaeus)

(Text-figs. 35 and 36)

A moderately long and robust species, with comparatively short antennae and long legs ; with numerous setae covering the body and appendages ; wings with a faint purplish tinge between anterior margin and 1st wing vein. When mounted, total body length 1800–2010 (average 1885) μ ; width at mesothorax 415–460 (average 434) μ. Wing expanse 3070–3320 (average 3170) μ.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 247–288 (average 269) μ, width across genae 247–266 (average 257) μ. *Median crest* sclerotized and distinctly polygonally reticulated; with numerous (20–34, average 28) fleshy *dorsal head setae* and 5–8 (average 6·7) hair-like ones. *Midcranial ridge* dorsally weak and irregular ; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, area surrounding ventral part showing weak polygonal reticulation. *Genae* large, weakly sclerotized and without polygonal reticulation ; each with 11–28 (average 20) fleshy and 1–5 (average 3) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 30–34 (average 32) μ in diameter and 1·1–1·8 (average 1·5) times as much apart ; those of the ventral eyes 30–34 (average 32) μ in diameter and 0·6–1·0 (average 0·7) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized dorsally, but weak ventrally ; polygonally reticulated throughout. *Preocular ridge* extending only a very short distance below articular process. *Postocular ridge* well developed throughout ; below ocellus the ridge splits up, with the anterior branch partly surrounding the ocellus. *Interocular ridge* absent.

Dorsal ocular setae : 0–5 (average 2·5) f.s. and 0–2 (average 0·6) h.s. on each side. *Ventral head setae* : 61–82 (average 71) f.s. and 4–6 (average 4·7) h.s., scattered over the ocular sclerite, always with some (2–6, average 4) f.s. occurring in front of this sclerite and with 13–18 (average 14) f.s. between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long *Cranial apophysis* long ; apex deeply bifurcate, extending to around the level of the anterior margin of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 840–901 (average 871) μ long, i.e. shorter than half body length (ratio 1 : 2·10–2·23, aversge 2·18), shorter than posterior leg (ratio 1 : 0·87–0·92, average 0·90) and longer than penial sheath (ratio 1 : 2·30–2·35, average 2·33). *Scape* 46–53 (average 47) μ long and 38–46 (average 43) μ wide, with 3 h.s. *Pedicel* : dorsal reticulation very weak or absent ; 51–61 (average 56) μ long and 42–49 (average 45) μ wide ; with 7–11 (average 8·6) f.s., 4–6 (average 5·1) h.s. and a sensillum placodeum. *Segment* III somewhat barrel-shaped, 1·9–2·4 (average 2·1) times longer than wide (57–65, average 60 μ long and 27–30, average 29 μ wide), with 5–15 (average 9·3) f.s. of medium length, 1·3–1·5 (average 1·4) times longer than width of segment ; with 2 or 3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 106–182 (average 144), 110–131 (average 119), 106–129 (average 118), 87–103 (average 95), 76–91 (average 83) and 68–84 (average 76) respectively, widths varying from 19 to 27 μ, with distal segments slightly wider than proximal ones ; with 23–44 (average 31), 25–30 (average 28), 22–32 (average 27), 20–30 (average 24), 15–20 (average 19) and 16–18 (average 18) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal part not constricted ; 72–76 (average 74) μ long and 25–29 (average 26) μ wide ; caryring 6–11 (average 8·3) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are almost as long as the segment and the 2 shorter

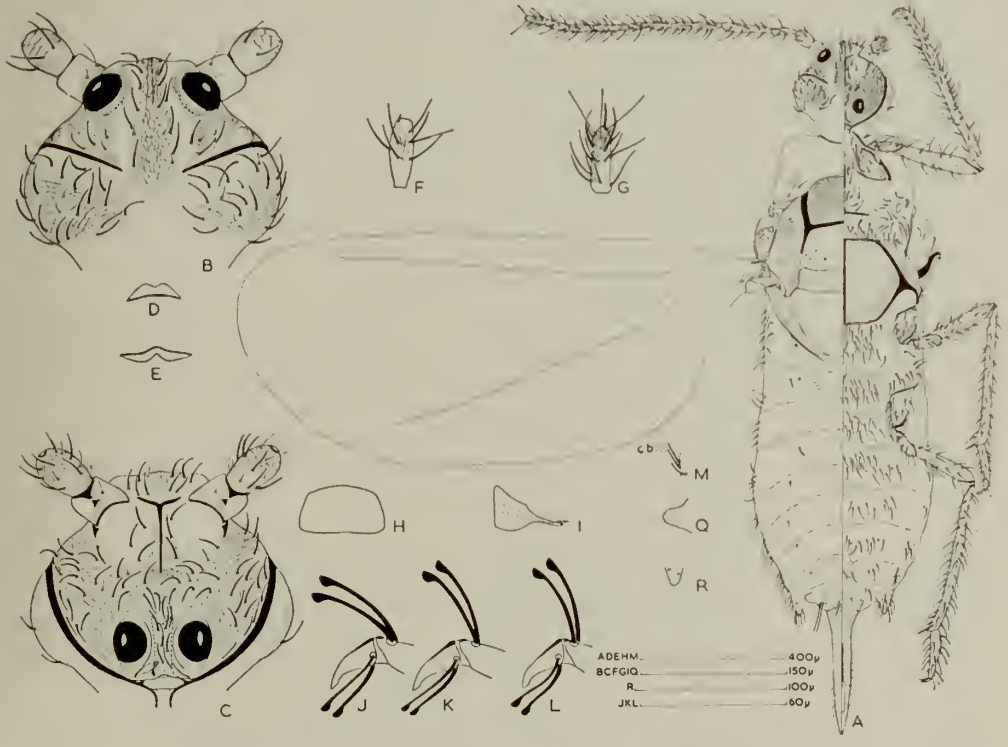


FIG. 35. *Pulvinaria ?betulae* (L.), dorsal and ventral view.

ones distinctly larger than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 650–749 (average 703) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* and pores absent. *Post-tergites* medium-sized, not striated, with 4–13 (average 7·8) fleshy *post-tergital setae* occurring on and behind the sclerite on each side. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, irregular median ridge and a small triangular sclerite. *Anteprosternal setae* : 0–6 (average 2·9) f.s. on each side ; *prosternal setae* : 10–54 (average 37) f.s. and 0–2 (average 1) h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about 1¾ times as wide as long (average 208 and 119 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially, reticulation weak or absent. *Scutum*. *Median membranous area* subrectangular ; 118–125 (average 123) μ long and 1·52–1·67 (average 1·59) times as wide (width 179–209, average 196 μ) ; with 15–28 (average 20) h.s. but no f.s. *Scutellum* 65–68 (average 67) μ long and 179–209 (average 196) μ wide, the ratio being 1 : 3·0–3·4 (average 3·2) ; tubular, with small ventral foramen ; without setae. *Postnotum* with anterior margin irregular, weakly sclerotized and either exposed or partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and occasionally with a fleshy *postalary seta*. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subalare* small. *Episternum* without polygonal reticulation ; *subepisternal ridge* becoming broader ventrally, but below membranous cleft indistinct and only marked by a band of darker sclerotization. *Epimeron* small. *Lateropleurite* not bounded by an extension from marginal ridge. *Basisternum* large, about 244 μ wide and 212 μ long, i.e. 1·67–1·78 (average 1·73) times longer than membranous area of scutum; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 58–85 (average 74) f.s. arranged in a broad band behind the spiracles and prosternum, with a few occurring on the episternae. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 4–8 (average 6) h.s. *Third axillary wing sclerite* with a small, pointed, ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 3–7 (average 4·8) f.s.

Metathorax. *Metanotum* with thickening of posterior margin usually desclerotized medially; *suspensorial sclerites* absent. *Postnotum* consisting of a small subtriangular sclerite on each side. *Metatergal setae* : one h.s. and usually one (0–2, average 0·9) f.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 10–19 (average 15) f.s. *Postmetaspiracular setae* : 19–32 (average 25) f.s. and 0–2 (average 1) h.s. *Metasternal plate* weak

Fig. 36. *Pulvinaria ?betulae* (L.), lateral view; also referable for lateral view of *P. acericola* (Walsh & Riley).

and irregular, but somewhat more heavily sclerotized near anterior margin. *Anterior metasternal setae* : 50–79 (average 68) f.s. and 0–4 (average 1·6) h.s. ; *posterior metasternal setae* : 28–39 (average 32) f.s. and occasionally 1–2 h.s.

Wings hyaline ; of medium length (1320–1470, average 1402 μ), but comparatively broad (width 580–700, average 637 μ), the ratio width to length being 1 : 2·10–2·27 (average 2·20) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs short and slender, with middle pair usually shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·94–2·03 (average 1·98). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61–70	80–101	201–243	346–422	137–152	27–29	827–1014
	(65)	(90)	(227)	(389)	(144)	(28)	(942)
II	72–89	91–99	182–213	357–410	133–148	26–28	870–977
	(83)	(96)	(198)	(383)	(139)	(27)	(926)
III	76–91	91–112	198–217	376–437	137–160	27–30	918–1034
	(83)	(103)	(206)	(403)	(149)	(29)	(972)

Coxae : 14–24 (average 21 f.s. on the fore and 25–36 on the middle and hind coxa, and each with 6–11 h.s. ; fore coxa with 2–4 (average 2·7) capitate coxal bristles ; apical seta about ½ as long as trochanter. *Trochanters* 26–31 μ wide ; with 6 oval sensilla, 11–22 f.s. and 6–8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·5–2·4 (average 2·1) times as long as width of trochanter. *Femora* of medium width (39–49 μ), ratio width to length of hind femur being 1 : 4·5–4·8 (average 4·6) ; with 28–48 f.s. and 7–14 h.s. *Tibiae* 21–27 μ wide, ratio width to length of hind tibia being 1 : 16·5–17·7 (average 17·0) ; each with 70–115 setae of which 16–31 are h.s. and 54–89 f.s., the latter about 1¾ to 2 times longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 21–23 μ wide, hind tarsus 6–7 (average 6·5) times longer than wide ; each with 23–28 f.s. and 10–18 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw, with small apical knob.

Abdomen 570–600 (average 594) μ long and 350–450 (average 410) μ wide.

Segments I–VII : *tergites* represented by 3 small sclerites, one medially and one on each side, on anterior margin of segments II–III, and a weak transverse plate on VII ; *sternites* usually present on all segments, represented by a weak transverse plate on segments II, III and VII, and a weak sclerite on each side on IV–VI. *Caudal extension* of segment VII extending beyond the level of posterior margin of segment VIII, tapering, weakly sclerotized laterоventrally. *Dorsal setae* : 0–2 (average 0·7), 0–1 (average 0·6), 0–1 (average 0·3), 0–3 (average 0·9), 0–1 (average 0·3) and 0–2 (average 0·3) f.s. on segments I–VI respectively ; one h.s. on each side on I and each of segments IV–VII, and very rarely a single seta on II and III. *Pleural setae* consisting of *dorsopleural setae* : 10–16 (average 13), 2–6 (average 4·1), 2–8 (average 4·2), 2–6 (average 4·3), 0–4 (average 2·7) and 0–4 (average 2·1) f.s. on I–VI and 0–1 (average 0·1), 0–3 (average 1·2), 2–3 (average 2·6), 2–5 (average 3·4) and 2–6 (average 3·5) h.s. on segments II–VI respectively, and of *ventropleural setae* : 0–2 (average 0·6) f.s. on VI and usually one h.s. on each of segments III–VI. Segment VII with 12–24 (average 20) f.s. and 4–12 (average 7·3) h.s. ; some of the posterior h.s. somewhat longer than the rest. *Ventral setae* : 26–42 (average 36), 22–33 (average 27), 11–18 (average 15), 9–15 (average 12), 9–16 (average 12) and 9–12 (average 11) f.s. on segments II–VII respectively ; usually one h.s. on each side on II–IV, and 4 (range 3–6) on segments V–VII.

Segment VIII with weak tergite and transverse sternite, the latter carrying 0–2 (average 0·7) f.s. ; caudal extension forming a mammillate lobe, with a small, membranous cicatrix laterally; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2½–3 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* 2–7 (average 4·4) f.s. and 2 strong h.s. Posterior margin with 2–3 (average 2·9) h.s. and an occasional f.s. on each side.

Genital segment. *Penial sheath* of medium length, about $\frac{1}{5}$ total body length (ratio 1 : 4·9–5·3, average 5·1), 365–388 (average 375) μ long and 40–46 (average 44) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about equal to $1\frac{1}{4}$ times that of aedeagus, extending anteriorly from the base of the aedeagus for $\frac{1}{2}$ to $\frac{3}{4}$ of the distance to the apex of the basal membranous area ; apex of sheath with a very small membranous extension. The area from base of sheath to tip of aedeagus with 22–31 (average 25) sensilla ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (72—82, average 75 μ long), penial sheath and basisternum longer, the ratios being 1 : 4·9–5·3 (average 5) and 1 : 2·56–3·08 (average 2·83) respectively.

Material examined : 7 specimens, collected by D. J. Williams on *Salix* sp. in Newcastle-on-Tyne, England during 1950.

In addition 10 specimens, received from Z. Kawecki (collected on *Ribes* sp. during August, 1962 in Warsaw, Poland) as *Pulvinaria ?ribesiae* Sign., were examined.

There are no distinct structural differences between the males of these two samples, and the various measurements, ratios and setal counts all overlapped. The description given above is based on the specimens from England. The characteristics of the specimens from Poland can be summarized as follows:

Total body length 1760–2160 (average 1963 μ). *Head* : Dorsal head setae 26–51 (average 34) f.s. and 5–10 (average 7·9) h.s. ; dorsal ocular setae 0–7 (average 3·6) f.s. and 0–3 (average 0·9) h.s. ; ventral head setae 54–108 (average 84) f.s. and 5–7 (average 6·1) h.s. of which 5–9 (average 6·6) f.s. occur in the area anterior to the ocular sclerite and 17–25 (average 21) between and behind the ventral eyes ; genal setae 18–30 (average 23) f.s. and 2–9 (average 4·6) h.s. ; antennae 809–999 (average 887) μ long, length in relation to body length 1 : 2·08–2·37 (average 2·23).

Thorax. Medial pronotal setae absent ; post-tergital setae 0–8 (average 2·3) f.s. on each side; prosternal setae 22–50 (average 33) f.s. and 1–3 (average 2·1) h.s. ; median membranous area of scutum 122–141 (average 128) μ long and 205–239 (average 223) μ wide (ratio 1 : 1·62–1·88, average 1·74), with 14–30 (average 21) h.s. ; fleshy postmesospiracular setae 67–84 (average 76) ; antemetaspiracular setae 3–9 (average 5·2) f.s. ; dorsospiracular setae 9–19 (average 13) f.s. ; postmetaspiracular setae 16–28 (average 23) f.s. and 0–4 (average 1·8) h.s. ; anterior and posterior metasternal setae 53–89 (average 79) and 37–54 (average 44) f.s. respectively ; wings 1340–1440 (average 1410) μ long and 610–670 (average 642) μ wide ; front coxa with 2–4 (average 3) knobbed coxal bristles. *Abdomen.* Pleural setae on segment VII 13–29 (average 22) f.s. and 3–8 (average 5·6) h.s. ; fleshy ventral setae on segments II–VII 33–56 (average 41), 23–49 (average 35), 18–26 (average 20), 13–27 (average 17) 10–17 (average 14) and 5–16 (average 11) respectively ; penial sheath 353–384 (average 367) μ long, length in relation to body length 1 : 5·15–5·63 (average 5·41) ; aedeagus 72–82 (average 77) μ long.

Pulvinaria acericola (Walsh & Riley)

(Text-figs. 37 and 36)

A moderately long, robust species with comparatively short antennae and legs ; with numerous setae covering the body and appendages ; wings with a faint purplish tinge between the anterior margin and first wing vein. When mounted, total body length 1670–1890 (average 1786) μ ; width at mesothorax 420–480 (average 458) μ. Wing expanse 2840–3140 (average 2978) μ.

Head subconical in dorsal view ; in lateral view obliquely elongated, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 228–293 (average 260) μ, width across genae 251–266 (average 257) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with numerous (19–43, average 30) fleshy *dorsal head setae* and 1–7 (average 5·2) hair-like ones.

Midcranial ridge dorsally weak and irregular ; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, area surrounding ventral part showing weak polygonal reticulation. *Genae* large, weakly sclerotized, but showing distinct polygonal reticulation ; each with 16–31 (average 23) fleshy and 1–9 (average 4·2) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 27–34 (average 31) μ in diameter and 1·7–2·4 (average 1·9) times as much apart ; those of the ventral eyes 27–34 (average 30) μ in diameter and 0·9–1·4 (average 1·1) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized dorsally, but weak ventrally ; polygonally reticulated throughout. *Preocular ridges* extending only a very short distance below articular process. *Postocular ridge* well developed throughout ; below ocellus the ridge splits up with the anterior branch partly surrounding the ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 0–6 (average 2·3) f.s. and 0–2 (average 0·5) h.s. on each side. *Ventral head setae* : 70–90 (average 80) f.s. and 4–7 (average 4·8) h.s., scattered over the ocular sclerite, always with some (4–7, average 4·8) f.s. occurring in front of this sclerite and with 10–15 (average 12) f.s. between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* long ; apex deeply bifurcate, extending to around the anterior margin of the ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 733–828 (average 794) μ long, i.e. shorter than half body length (ratio 1 : 2·08–2·45, average 2·24), shorter than posterior leg (ratio 1 : 0·78–0·81, average 0·80) and longer than penial sheath (ratio 1 : 2·14–2·35, average 2·20). *Scape* 46–53 (average 49) μ long and 34–46 (average 41) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 53–65 (average 61) μ long and 38–46 (average 43) μ wide ; with 10–15 (average 12) f.s., 3–5 (average 4) h.s. and a sensillum placodeum. *Segment* III somewhat barrel-shaped, 2·1–2·3 (average 2·2) times longer than wide (57–72, average 64 μ long and 23–29, average 26 μ wide) ; with 9–19 (average 12) f.s. of medium length, 1·6–1·8 (average 1·7) times longer than width of segment ; with 1 to 3 usual sensilla basiconica. *Segments* IV–IX

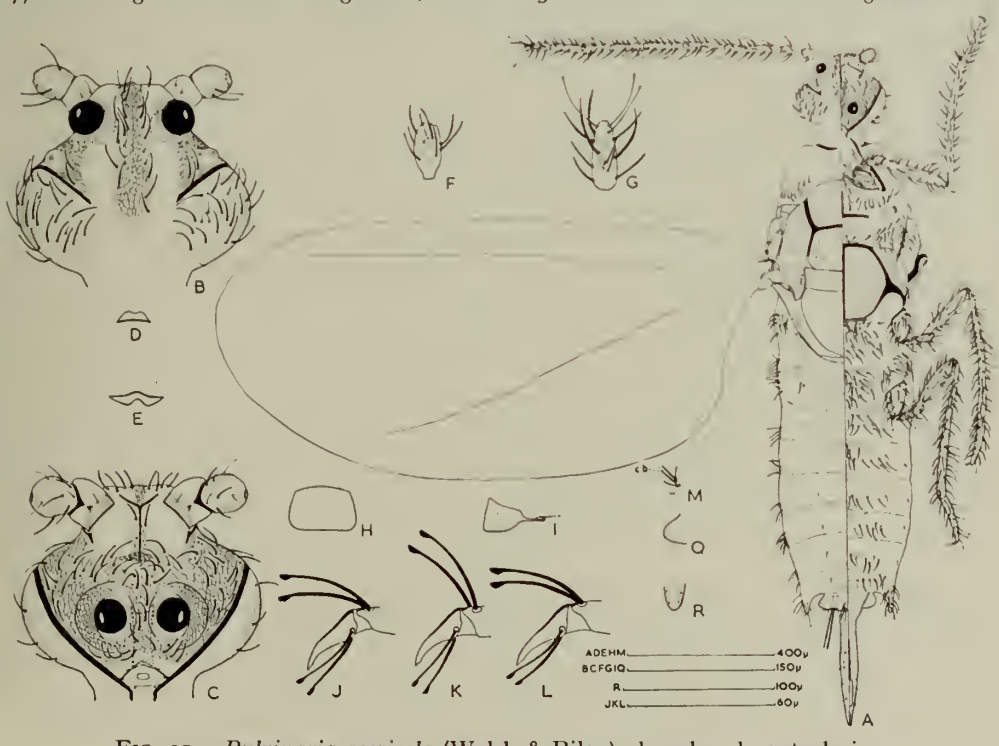


FIG. 37. *Pulvinaria acericola* (Walsh & Riley), dorsal and ventral view.

cylindrical ; lengths of these segments (in μ) 110–133 (average 122), 95–133 (average 114), 87–118 (average 106), 80–122 (average 94), 57–72 (average 66) and 53–65 (average 59) respectively, widths varying from 21–29 μ, with distal segments slightly wider than proximal ones ; with 19–31 (average 25), 23–36 (average 29), 20–35 (average 27), 21–27 (average 24), 17–25 (average 22) and 14–21 (average 17) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal part not constricted ; 53–68 (average 59) μ long and 22–29 (average 23) μ wide ; carrying 6–13 (average 10) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about $\frac{3}{4}$ as long as the segment and the 2 shorter ones about $\frac{1}{2}$ as long as the f.s. ; with two sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 635–741 (average 687) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* and pores absent. *Post-tergites* medium-sized, with irregular wavy striations and usually with some 0–7, (average 3·9) fleshy *post-tergital setae* occurring on or behind the sclerite on each side. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, weak and interrupted median ridge, and a small triangular sclerite. *Anteprosternal setae* : 2–7 (average 3·6) f.s. on each side ; *prosternal setae* : 7–19 (average 14) f.s. and occasionally one h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* about $1\frac{3}{4}$ times as wide as long (average 218 μ and 119 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially ; showing polygonal reticulation, which sometimes tends to be irregular. *Scutum*. *Median membranous area* subrectangular ; 99–139 (average 124) μ long and 1·53–2·04 (average 1·76) times as wide (width 201–228, average 212 μ) ; with 6–20 (average 14) h.s. and rarely 2 f.s. *Scutellum* 65–72 (average 69) μ long and 213–247 (average 231) μ wide, ratio being 1 : 3·0–3·8 (average 3·4) ; tubular, with moderately large ventral foramen ; without setae. *Postnotum* with anterior margin irregular, weakly sclerotized and either exposed or partly overlapped by metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and without setae. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subalare* small. *Episternum* usually showing weak polygonal reticulation dorsally ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* not bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 287 μ wide and 214 μ long, i.e. 1·45–2·00 (average 1·74) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges*; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 55–79 (average 66) f.s., arranged in a broad band behind the spiracles and prosternum, with a few occurring on the episternae. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 2–7 (average 5) h.s. *Third axillary wing sclerite* with a small, pointed, ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 1–7 (average 2·9) f.s.

Metathorax. *Metanotum* with thickening of posterior margin usually desclerotized medially; *suspensorial sclerites* absent. *Postnotum* consisting of a small transverse sclerite on each side. *Metatergal setae* : one h.s. and usually a few (0–6, average 2·4) f.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 10–23 (average 16) f.s. *Postmetaspiracular setae* : 12–25 (average 16) f.s. and 0–2 (average 0·8) h.s. *Metasternal plate* weak and irregular, but more heavily sclerotized anteriorly. *Anterior* and *posterior metasternal setae* consisting of 58–94 (average 77) and 34–49 (average 38) f.s. respectively.

Wings : hyaline ; of medium length (1230–1350, average 1292 μ) but comparatively broad width (660–690, average 670 μ), ratio width to length being 1 : 1·86–1·97 (average 1·93) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs moderately long and slender, with the fore pair usually shortest and the hind pair longest ; the ratio length of hind leg to body length is 1 : 1·76–1·85 (average 1·79). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61–72	87–99	205–243	369–422	118–133	19–25	864–998
	(65)	(95)	(227)	(391)	(126)	(24)	(928)
II	80–91	99–114	194–220	372–418	118–133	23–25	890–991
	(86)	(108)	(208)	(391)	(125)	(24)	(941)
III	84–91	106–116	193–228	399–456	125–144	25–30	942–1056
	(87)	(112)	(211)	(422)	(135)	(27)	(995)

Coxae : 11–24 (average 18), 18–29 (average 23) and 22–30 (average 26) f.s. on the fore, middle and hind coxa respectively, and each with 7–11 h.s. ; fore coxa with 3–5 (average 4) capitate coxal bristles ; apical seta about ½ as long as trochanter. *Trochanters* 30–38 μ wide ; with 6 oval sensilla ; with 11–16 (average 13) f.s. on the fore and 10–22 on the middle and hind trochanters ; each with 5–8 h.s., the latter including 2 or 3 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·6–1·8 (average 1·7) times as long as the width of trochanter. *Femora* of medium width (41–53 μ), the ratio width to length of hind femur being 1 : 3·9–4·6 (average 4·2) ; each with 28–47 f.s. and 8–16 h.s. *Tibiae* 24–30 μ wide, the ratio width to length of hind tibia being 1 : 13·5–16·6 (average 14·9) ; each with 90–118 setae of which 14–22 are h.s. and 72–100 f.s., the latter about 1½–2 times longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 21–27 μ wide, hind tarsus 4·3–5·2 (average 5) times longer than wide ; each with 22–32 f.s. and 5–11 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* of medium length, length about equal to width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 450–570 (average 538) μ long and 400–450 (average 427) μ wide.

Segments I–VII : *tergites* on segmenst II–III represented by 3 small sclerites on anterior margin—one medially and one on each side, on segment IV by a small sclerite on each side, and on VII by a weak transverse plate ; *sternites* represented by a weak transverse plate on segments II, III and VII, and sometimes by a small weak sclerite on each side on IV and VI. *Caudal extension* of segment VII large, extending beyond level of posterior margin of segment VIII, tapering, weakly sclerotized lateroventrally. *Dorsal setae* : a few (up to 4) f.s. occasionally present ; usually one h.s. on each side on segment I and each of IV–VII but none on II and III. *Pleural setae* consisting of *dorsopleural setae* : 0–8 (average 4·4), 1–8 (average 3·5), 0–9 (average 3·3), 0–9 (average 3·6), 4–13 (average 6·4) and 1–9 (average 3·9) f.s. on segments I–VI respectively and 0–2 (average 0·3), 0–2 (average 1), 1–5 (average 2·8), 0–3 (average 2·4) and 1–5 (average 2·6) h.s. on II–VI and of *ventropleural setae* : one or two f.s. occasionally present on segments III–IV, and 0–6 (average 2) and 0–6 (average 2·4) on V–VI respectively, with usually one h.s. on each of segments IV–VI. Segment VII with 9–24 (average 15) f.s. and 4–6 (average 4·8) h.s. ; some of the posterior h.s. somewhat longer than rest. *Ventral setae* : 22–42 (average 33), 20–37 (average 28), 8–22 (average 16), 5–19 (average 12), 5–16 (average 10), 3–6 (average 4·6) f.s. on segments II–VII respectively ; usually no h.s. on II, one on each side on III–IV and 4 (range 3–6) on each of segments V–VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a mammillate lobe with a small, membranous cicatrix laterally ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2–3 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : usually a few (0–5, average 1·2) f.s. and 2 (0–2, average 1·3) strong h.s. present. Posterior margin with 2–3 (average 2·7) h.s. on each side.

Genital segment. *Penial sheath* of medium length, about ⅕ total body length (ratio 1 : 4·8–5·2, average 5), 342–369 (average 357) μ long and 38–53 (average 44) μ wide ; lateral sclerotiza-

tions narrowly joined anterior to anus ; length of *basal rod* equal to about $1\frac{1}{4}$ times that of aedeagus, extending anteriorly from the base of the aedeagus for $\frac{1}{2}$–$\frac{3}{4}$ of the distance to the apex of the basal membranous area ; apex of sheath with a very small membranous extension. Area from base of sheath to tip of aedeagus with 24–35 (average 28) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (76–95, average 85 μ long), penial sheath and basisternum longer, the ratios being 1 : 3·6–4·8 (average 4·3) and 1 : 2·26–2·95 (average 2·59) respectively.

Material examined : 9 specimens ; collected by T. E. Tabor on *Acer saccharinum* L. in Hillsville, Virginia, U.S.A. on 6.v.63 ; received from M. Kosztarab, identified by K. Boratyński.

P. acericola can readily be separated from *P. betulae* by the 2 short antennal bristles on antennal segment X and also by the distinct polygonal reticulation on the pedicel, gena and mesoprescutum.

PARTHENOLECANIUM

Parthenolecanium corni (Bouché)

(Text-figs. 38 and 40)

A medium-sized and moderately robust species, with comparatively short antennae and long legs ; with numerous setae on the body and appendages. When mounted, total body length 1880–2110 (average 1980) μ ; width at mesothorax 390–500 (average 446) μ. Wing expanse 3030–3400 (average 3283) μ.

Head subconical in dorsal view ; in lateral view obliquely elongated dorsoventrally, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 239–293 (average 273) μ, width across genae 258–289 (average 275) μ. *Median crest* sclerotized and distinctly polygonally reticulated ; with 23–37 (average 28) fleshy and 16–19 (average 17) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. *Genae* large, sclerotized, polygonally reticulated ; each with 17–30 (average 23) fleshy and 7–13 (average 9·1) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 34–42 (average 38) μ in diameter and 1·2–1·7 (average 1·5) times as much apart ; those of the ventral eyes 34–42 (average 38) μ in diameter and 0·5–0·8 (average 0·7) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* extending only a short distance below articular process. *Postocular ridge* usually well developed throughout, usually with a weak anterior branch below ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 1–7 (average 4·1) f.s. and 0–4 (average 2) h.s. on each side. *Ventral head setae* : 65–83 (average 70) f.s. and 7–12 (average 9) h.s., scattered over the ocular sclerite, occasionally with one or two f.s. occurring in front of the sclerite, and with 12–17 (average 15) f.s. and 0–2 (average 0·7) h.s. between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate, without central bulge, not reaching the level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* apparently absent.

Antennae 10-segmented, filiform ; 825–998 (average 895) μ long, i.e. shorter than half body length (ratio 1 : 2·06–2·41, average 2·23), shorter than posterior leg (ratio 1 : 0·77–0·89, average 0·82) and longer than penial sheath (ratio 1 : 1·89–2·10, average 1·95). *Scape* 49–61 (average 55) μ long and 42–53 (average 48) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 61–68 (average 64) μ long and 42–49 (average 46) μ wide ; with 7–11 (average 9·3) f.s., 5–8 (average 6) h.s. and a sensillum placodeum. *Segment* III club-shaped, 2·1–2·4 (average 2·3) times longer than wide (61–84, average 66 μ long and 27–34, average 28 μ wide) ;

with 10–15 (average 13) f.s. of medium length, 1·1–1·4 (average 1·2) times longer than width of segment ; with 1–4 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 171–220 (average 192), 103–141 (average 114), 99–113 (average 107), 80–103 (average 90), 65–84 (average 73) and 53–68 (average 59) respectively, all of about the same width, varying from 21 to 29 μ ; with 38–67 (average 53), 31–46 (average 36), 32–54 (average 36), 27–38 (average 32), 22–30 (average 25) and 17–25 (average 20) f.s., but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal $\frac{1}{3}$ somewhat constricted ; carrying 7–13 (average 9·4) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about $\frac{2}{3}$ as long as the segment and the 2 shorter ones somewhat shorter and thicker than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 669–790 (average 733) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, occasionally with one fleshy *lateral pronotal seta* on each side. *Medial pronotal setae* absent. *Post-tergites* comparatively large, with irregular, wavy striations ; *post-tergital setae* absent. *Pleural structures* typical of the family. *Sternum* with strong transverse ridge, interrupted median ridge and small triangular sclerite. *Anteprosternal setae* : 1–3 (average 2·1) f.s. on each side ; *prosternal setae* 19–30 (average 26) f.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* less than twice as wide as long (average 223 and 127 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily

FIG. 38. *Parthenolecanium corni* (Bouché), dorsal and ventral view.

sclerotized medially ; polygonally reticulated. *Scutum*. *Median membranous area* subrectangular ; 118–133 (average 128) μ long and 1·53–1·82 (average 1·61) times as wide (width 182–236, average 206 μ) ; with 11–26 (average 20) h.s., but no f.s. *Scutellum* 65–87 (average 74) μ long and 198–247 (average 220) μ wide, ratio being 1 : 2·9–3·3 (average 3) ; tubular ; ventral foramen small, its length usually less than half that of scutellum ; without setae. *Postnotum* with anterior margin weakly sclerotized, irregular, and usually not overlapped by metathoracic fold ; polygonally reticulated dorsally ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and without setae. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subulare* small, *Episternum* showing polygonal reticulation dorsally ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* not bounded anteriorly by an extension from marginal ridge. *Basisternum* : large, about 270 μ wide and 214 μ long, i.e. 1·50–1·82 (average 1·68) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 71–98 (average 89) f.s. and 0–2 (average 0·9) h.s., arranged in a broad band behind the spiracles and prosternum. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 6–8 (average 7·2) h.s. *Third axillary wing sclerite* with a small ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 4–12 (average 6·5) f.s.

Metathorax. *Metanotum* with posterior margin desclerotized medially ; *suspensorial sclerites* absent ; a small, additional sclerite sometimes present anterior to postnotum. *Postnotum* consisting of a small, transverse sclerite on each side. *Metatergal setae* : 0–2 (average 0·8) f.s. and 0–2 (average 1) h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* usually present. *Episternum* reduced to a small plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 5–14 (average 10) f.s. *Postmetaspiracular setae* : 21–35 (average 30) f.s. and 0–2 (average 0·9) h.s. *Metasternal sclerite* represented by a weak transverse plate. *Anterior* and *posterior metasternal setae* : 76–94 (average 86) and 31–60 (average 42) f.s. respectively.

Wings hyaline ; short (length 1330–1510, average 1439 μ) but comparatively broad (width 620–740, average 686 μ), the ratio width to length being 1 : 2·04–2·15 (average 2·10) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs long and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·74–1·84 (average 1·81). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	72–80	99–118	247–285	395–452	125–141	24–29	984–1091
	(76)	(108)	(271)	(429)	(132)	(26)	(1042)
II	87–95	106–118	224–262	418–471	137–143	27–30	1003–1113
	(92)	(112)	(244)	(444)	(140)	(28)	(1062)
III	95–107	106–122	232–266	441–479	137–152	27–32	1051–1146
	(102)	(117)	(251)	(465)	(144)	(29)	(1109)

Coxae : 17–24 (average 20) f.s. on the fore and 23–43 on the middle and hind coxa, and each with 10–19 h.s. ; fore coxa with 3–4 (average 3·5) capitate coxal bristles ; apical seta about $\frac{1}{2}$–$\frac{2}{3}$ as long as trochanter. *Trochanters* 29–34 μ wide ; with 6 oval sensilla, 12–21 f.s. and 8–11 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 2·6–3·4 (average 3) times as long as width of trochanter. *Femora* of medium width (42–53 μ), ratio width to length of hind femur being 1 : 4·8–5·7 (average 5·2) ; with 36–54 f.s. and 15–27 h.s. *Tibiae* 23–30 μ wide, ratio width to length of hind tibia being 1 : 15·0–19·1 (average 16·4) ; each with 107–153 setae, of which 30–47 are h.s. and 76–110 f.s., the latter about as long as width of tibia ; apical spur about the

same size on all tibiae. *Tarsi* 21–27 μ wide, with 13–28 f.s. and 16–26 h.s. ; *tarsal digitules* subequal, somewhat longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 520–600 (average 570) μ long and 390–500 (average 425) μ wide.

Segments I–VII : *tergites* represented by a small sclerite on each side on anterior margin of segments II–III and a weak transverse plate on VII ; *sternites* represented by a weak transverse sclerite on segments II, III, sometimes VI, and VII. *Caudal extension* of segment VII large, reaching or extending beyond the level of posterior margin of segment VIII, tapering, weakly sclerotized. *Dorsal setae* : occasionally one f.s. on segments I–II ; usually one h.s. on each side on I and each of segments IV–VII. *Pleural setae* consisting of *dorsopleural setae* : 1–7 (average 3·4), 1–6 (average 2·5), 1–4 (average 2·2), 2–6 (average 3·9), 1–6 (average 3·1) and 0–3 (average 1·4) f.s., and 0–2 (average 0·9), 0–1 (average 0·1), 0–1 (average 0·3), 1–4 (average 1·8), 0–5 (average 3·3), and 2–5 (average 3·9) h.s. on segments I–VI respectively, and of *ventropleural setae* : 0–3 (average 1·1) f.s. on VI and usually one h.s. on each of segments IV–VI. Segment VII with 10–17 (average 15) f.s. and 5–12 (average 7·3) h.s. ; some of the posterior h.s. usually longer than the rest. *Ventral setae* : 30–38 (average 34), 13–23 (average 20), 8–18 (average 15), 5–11 (average 7·6), 5–11 (average 7·8) and 4–9 (average 6·5) f.s. on segments II–VII respectively; usually one h.s. on each side on segments III–IV and 4 on each of V–VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a small, sclerotized, papilla-shaped lobe with a small, membranous cicatrix laterally ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 2½–3 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : 2 strong h.s. which are sometimes forked. Posterior margin with 3 h.s. on each side.

Genital segment. *Penial sheath* long, about ¼ total body length (ratio 1 : 4·19–4·44, average 4·38), 456–486 (average 470) μ long and 45–49 (average 46) μ wide at base of aedeagus ; lateral sclerotizations not joined anterior to anus ; length of *basal rod* about ⅔ or equal that of aedeagus, extending anteriorly from base of the aedeagus for about ⅓ of the distance to apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 20–30 (average 25) small setae ; a cluster of small sensilla occurring near apex of sheath. *Aedeagus* short (106–125, average 114 μ long), penial sheath and basisternum longer, the ratios being 1 : 3·9–4·3 (average 4·1) and 1 : 1·79–2·67 (average 1·99) respectively.

Material examined : 8 specimens, collected by Z. Kawecki on *Ribes aureum* Pursh. and *Ribes* sp. in Warsaw, Poland during January, 1962.

In addition, ten specimens were examined from Belgrade, Yugoslavia (received from N. Mitić-Mužina, collected on an unknown host during 1961) and two from Alma-Ata, Kazakhstan, USSR (received from G. Matesova, collected in fruit orchards on 20.iv.51). These specimens were all smaller than the specimens from Warsaw, consequently the measurements of the various structures and the numbers of setae are somewhat reduced ; otherwise they are practically identical. On the other hand, the specimens that Habib (1956) described from *Cotoneaster microphylla* Lindl., collected in Wisley, England, were bigger (2100–2300, average 2200 μ long). It is worthy of note that the females of this species also show considerable size variation, due mainly to the influence of the host plant (Habib, 1953 and Kawecki, 1958a).

The variation in the specimens from Poland, Yugoslavia and the USSR can be summarized as follows (all measurements in μ) :

VARIATION IN *P. corni* FROM THREE LOCALITIES

Characters	Localities		
	Warsaw	Belgrade	Alma-Ata
Total length	1880–2110 (1980)	1470–1770 (1660)	1650–1850 (1750)
Wing expanse	3030–3400 (3283)	2470–3110 (2856)	2950–3130 (3040)
HEAD:			
Width across genae	258–289 (275)	217–274 (250)	251–258 (255)
Dorsal head setae: fleshy	23–37 (28)	19–46 (29)	18–23 (21)
Dorsal head setae: hair-like	16–19 (17)	10–22 (15)	19–21 (20)
Genal setae: fleshy	17–30 (23)	16–30 (22)	21–25 (23)
Genal setae: hair-like	7–13 (9)	7–12 (9)	10–11
Diameter of dorsal eyes	34–42 (38)	23–34 (28)	30–31
Diameter of ventral eyes	34–42 (38)	23–36 (29)	34
Ventral head setae: fleshy	65–83 (70)	57–92 (72)	69–76 (73)
Ventral head setae: hair-like	7–12 (9)	3–7 (5)	4
Antennal length	825–998 (895)	659–827 (740)	906
Antennal length in relation to body length	1 : 2·06–2·41 (2·23)	1 : 2·12–2·33 (2·24)	1 : 2·04
THORAX			
Prosternal setae: fleshy	22–39 (31)	18–40 (28)	13–28 (20)
Median membranous area of scutum: length:	118–133 (128)	84–118 (101)	103
Median membranous area of scutum: width:	182–236 (206)	135–194 (173)	179–190 (184)
scutal setae (hair-like)	11–26 (20)	10–22 (15)	13–16 (15)
Scutellum: length	65–87 (74)	46–65 (57)	65–76 (70)
Scutellum: width	198–247 (220)	144–205 (184)	182–205 (194)
Basisternum: length	194–236 (214)	156–201 (182)	213

Characters	Localities		
	Warsaw	Belgrade	Alma-Ata
Basisternum: width	233–304 (270)	194–262 (237)	266–277 (272)
Postmesospiracular setae (fleshy)	71–98 (89)	44–85 (63)	73–80 (77)
Tegular setae (hair-like)	6–8 (7·2)	4–9 (5·7)	7–9 (8·0)
Antemetaspiracular setae (fleshy)	4–12 (6·5)	2–5 (3·1)	5
Dorsospiracular setae (fleshy)	5–14 (10)	5–15 (10)	7
Postmetaspiracular setae (fleshy)	21–35 (30)	15–34 (19)	18
Anterior metasternal setae: fleshy	76–94 (86)	40–82 (57)	76
Posterior metasternal setae: fleshy	31–60 (42)	18–45 (29)	39–50 (45)
Wing length	1330–1510 (1439)	1100–1380 (1260)	1310–1400 (1355)
Wing width	620–740 (686)	480–650 (598)	650–710 (680)
Ratio width to length	1 : 2·04–2·15 (2·10)	1 : 1·10–2·31 (2·18)	1 : 1·97–2·02 (2·00)
Hind leg: length	1051–1146 (1109)	832–1098 (973)	1064–1139 (1102)
length in relation to body length	1 : 1·74–1·84 (1·81)	1 : 1·72–1·77 (1·75)	1 : 1·62
Tibial setae	107–153	81–123	101–127
ABDOMEN			
Pleural setae on segment VII: fleshy	10–17 (15)	11–25 (20)	11–14 (12)
Ventral setae on segment II: fleshy	30–38 (34)	13–42 (25)	26–31 (29)
Penial sheath: length	456–486 (470)	361–410 (394)	410–429 (420)
length in relation to body length	1 : 4·19–4·44 (4·38)	1 : 3·91–4·39 (4·23)	1 : 3·84–4·51 (4·28)
Aedeagus: length	106–125 (114)	91–114 (100)	114

Parthenolecanium pomeranicum (Kawecki)

(Text-figs. 39 and 40)

A medium-sized and moderately robust species, with comparatively short antennae and long legs ; with numerous setae on the body and appendages. When mounted, total body length 1610–1800 (average 1690) μ ; width at mesothorax 405–450 (average 418) μ. Wing expanse 2590–2910 (average 2750) μ.

Head subconical in dorsal view ; in lateral view obliquely elongated dorsoventrally, with anterodorsal bulge pronounced ; length from apex to pronotal ridge 243–277 (average 261) μ, width across genae 247–281 (average 265) μ. *Median crest* well sclerotized and distinctly polygonally reticulated ; with 15–32 (average 24) fleshy and 10–17 (average 13) hair-like *dorsal head setae*. *Midcranial ridge* dorsally absent ; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. *Genae* large, sclerotized, polygonally reticulated ; each with 14–24 (average 19) fleshy and 6–13 (average 6·9) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 23–27 (average 25) μ in diameter and 2·7–3·3 (average 3) times as much apart ; those of the ventral eyes 23–30 (average 26) μ in diameter and 1·1–1·5 (average 1·3) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* extending only a short distance below articular process. *Postocular ridge* well developed dorsally and lateroventrally, but usually weak posteromedially ; below ocellus the ridge usually has a weak anterior branch. *Interocular ridge* absent. *Dorsal ocular setae* : 2–8 (average 4·2) f.s. and 0–4 (average 1·6) h.s. on each side. *Ventral head setae* : 44–60 (average 51) f.s. and 8–15 (average 10) h.s., scattered over the ocular sclerite, occasionally with a fleshy seta occurring in front of the sclerite, and with 9–16 (average 13) f.s. and 0–1 (average 0·6) h.s. between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate, sometimes with central bulge, not reaching level of anterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

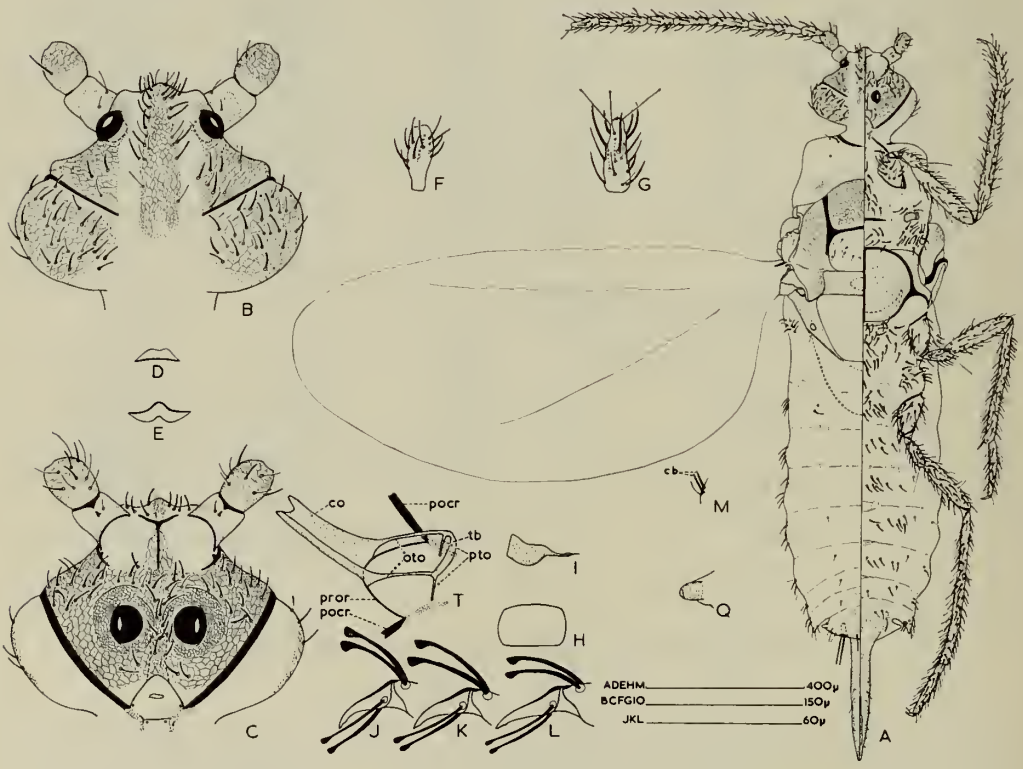


FIG. 39. *Parthenolecanium pomeranicum* (Kaw.), dorsal and ventral view.

Antennae 10-segmented, filiform ; 686–758 (average 730) μ long, i.e. shorter than half body length (ratio 1 : 2·20–2·54, average 2·39), shorter than posterior leg (ratio 1 : 0·72–0·74, average 0·73) and longer than penial sheath (ratio 1 : 1·92–2·09, average 2·01). *Scape* 49–57 (average 53) μ long and 40–44 (average 42) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 49–57 (average 53) μ long and 42–46 (average 43) μ wide ; with 3–8 (average 5·1) f.s., 5–9 (average 6·9) h.s. and a sensillum placodeum. *Segment* III : club-shaped, 2·0–2·9 (average 2·3) times longer than wide (53–63, average 59 μ long and 21–27, average 26 μ wide) ; with 8–15 (average 13) f.s. of medium length, 1·0–1·4 (average 1·2) times longer than width of segment ; with 1–4 usual sensilla basiconica. *Segments* IV–IX : cylindrical ; lengths of these segments (in μ) 95–122 (average 113), 84–114 (average 97), 93–99 (average 95), 65–91 (average 75), 57–78 (average 66) and 46–57 (average 52) respectively, all of about the same width, varying from 19 to 27 μ ; with 21–33 (average 30), 22–36 (average 32), 28–43 (average 36), 23–37 (average 27), 19–30 (average 21) and 16–23 (average 19) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than the fleshy setae. *Segment* X : terminal $\frac{1}{3}$ somewhat constricted ; carrying 10–15 (average 12) f.s., occasionally one h.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are just more than half as long as the segment and the 2 shorter ones somewhat shorter and thicker than the f.s. ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 638–688 (average 660) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, with 0–3 (average 1·1) fleshy and 0–3 (average 0·5) hair-like *lateral pronotal setae* on each side. *Medial pronotal setae* : usually one h.s. and occasionally one f.s. on each side. *Post-tergites* comparatively large, with irregular wavy striations ; *post-tergital setae* absent. *Pleural structures* typical of family. *Sternum* with transverse ridge strong, median ridge weak and only represented anteriorly, and a well sclerotized triangular sclerite. *Anteprosternal setae* : 0–4 (average 1·3) f.s. on each side ; *prosternal setae* : 13–21 (average 15) f.s. and sometimes one h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with shallow emargination. *Prescutum* less than twice as wide as long (average 115 and 201 μ respectively) ; anterior margin strongly curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; slightly more heavily sclerotized medially ; polygonally reticulated. *Scutum*. *Median membranous area* subrectangular ; 103–118 (average 111) μ long and 1·50–1·78 (average 1·60) times as wide (width 175–182, average 178 μ) ; with 14–22 (average 19) h.s., but no f.s. *Scutellum* 53–61 (average 58) μ long and 175–182 (average 178) μ wide, ratio being 1 : 2·9–3·8 (average 3·3) ; tubular, with a large ventral foramen of which the length is half or more than half that of the scutellum ; without setae. *Postnotum* with anterior margin weakly sclerotized, irregular, and partly overlapped by the metathoracic fold ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and without setae. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural*

FIG. 40. *Parthenolecanium pomeranicum* (Kaw.), lateral view; also referable for lateral view of *P. corni* (Bouché).

apophysis and *pleural wing process* well developed. *Basalare* vestigial, incorporated into pleural wing process, not joining the latter with episternum. *Subalare* small. *Episternum* showing polygonal reticulation dorsally ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Laterotpleurite* not bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 240 μ wide and 179 μ long, i.e. 1·48–1·74 (average 1·61) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* numerous, consisting of 54–64 (average 57) f.s. and 2–5 (average 3·8) h.s., arranged in a broad band behind the spiracles and prosternum. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 3–9 (average 5·4) h.s. *Third axillary wing sclerite* with a small ventral projection at its base. *Additional sclerite* small, well sclerotized. *Antemetaspiracular setae* : 2–8 (average 5·3) f.s.

Metathorax. *Metanotum* with posterior margin desclerotized medially ; *suspensorial sclerites* absent. *Postnotum* consisting of a small transverse sclerite on each side. *Metatergal setae* : 0–3 (average 0·6) f.s. and 1–3 (average 1·3) h.s. on each side. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* usually present. *Episternum* reduced to a small plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 3–11 (average 7·8) f.s. and 0–3 (average 1) h.s. *Postmetaspiracular setae* : 14–24 (average 18) f.s. and 1–4 (average 2·2) h.s. *Metasternal sclerite* represented by a weak, transverse plate. *Anterior* and *posterior metasternal setae* : 56–74 (average 64) and 20–32 (average 28) f.s. respectively.

Wings hyaline; short (length 1130–1290, average 1210 μ) but comparatively broad (width 520–590, average 557 μ), ratio width to length being 1 : 2·15–2·20 (average 2·17) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs long and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·69–1·84 (average 1·77). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61–72	76–87	222–241	338–372	118–141	24–27	868–918
	(67)	(81)	(231)	(355)	(130)	(25)	(890)
II	76–87	84–91	201–224	353–380	133–148	25–27	882–948
	(81)	(87)	(209)	(366)	(140)	(26)	(972)
III	76–95	80–99	209–228	372–410	141–163	26–29	934–1017
	(87)	(92)	(216)	(391)	(150)	(27)	(963)

Coxae : 12–16 (average 13) f.s. on the fore and 24–32 on the middle and hind coxa, and each with 13–20 h.s. ; fore coxa with 2–5 (average 3·8) coxal bristles ; apical seta about $\frac{2}{3}$ as long as trochanter. *Trochanters* 28–32 μ wide ; with 6 oval sensilla ; with 9–12 (average 11) f.s. on the fore and 14–18 on the middle and hind trochanter, and each with 8–14 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 2·2–2·8 (average 2·5) times as long as width of trochanter. *Femora* of medium width (42–49 μ), ratio width to length of hind femur being 1 : 4·5–4·9 (average 4·6) ; each with 26–42 f.s. and 20–37 h.s. *Tibiae* 23–30 μ wide, ratio width to length of hind tibia being 1 : 12·3–16·3 (average 14·2) ; each with 120–150 setae of which 44–64 are h.s. and 68–92 f.s., the latter about as long as width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 19–25 μ wide, hind tarsus 6·2–8·6 (average 7) times longer than wide ; each with 8–19 f.s. and 27–37 h.s. ; *tarsal digitules* subequal, about as long as claw. *Claws* of medium length, somewhat longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 440–550 (average 491) μ long and 410–530 (average 460) μ wide.

Segments I–VII : *tergites* represented by a small sclerite on each side on anterior margin of segments II–III and by a weak transverse plate on VII ; *sternites* represented by a weak transverse sclerite on segments II, III and VII. *Caudal extension* of segment VII large, reaching or

extending beyond the level of posterior margin of segment VIII, tapering, weakly sclerotized. *Dorsal setae* : occasionally one or two f.s. on the 1st segment ; usually one h.s. on each side on I and each of segments IV–VII. *Pleural setae* consisting of *dorsopleural setae* : 1–5 (average 2·1), 0–4 (average 1·5), 0–5 (average 1·7), 1–4 (average 2·6), 0–3 (average 2) and 0–4 (average 1·4) f.s., and 0–1 (average 0·2), 0–2 (average 0·9), 0–3 (average 1·5), 1–4 (average 2·8), 1–3 (average 2·1) and 0–2 (average 1·6) h.s. on segments I–VI respectively, and *ventropleural setae* : occasionally one f.s. on segments V–VI, sometimes one h.s. on IV and usually one on each of segments V–VI. Segment VII with 4–8 (average 5·4) f.s. and 4–8 (average 5·9) h.s. ; some of the posterior h.s. usually longer than the rest. *Ventral setae* : 9–18 (average 13), 6–16 (average 11), 9–14 (average 11), 5–11 (average 7·3), 4–11 (average 7·1) and 1–4 (average 2·7) f.s. on segments II–VII respectively ; usually one h.s. on each side on segments III–IV and 4 on each of V–VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a large, papilla-shaped lobe with a small, membranous cicatrix laterally ; *glandular pouch* with 2 long, pointed setae, whose protruding part is about twice as long as section within pouch. Small IXth tergite sometimes present. *Ante-anal setae* : 2 strong h.s., which are sometimes forked. Posterior margin with 2–3 (average 2·8) h.s. on each side.

Genital segment. *Penial sheath* of medium-length, about $\frac{1}{5}$ total body length (ratio 1 : 4·40–5·09, average 4·77), 342–361 (average 353) μ long and 36–42 (average 38) μ wide ; lateral sclerotizations apparently not joined anterior to anus ; *basal rod* about $\frac{1}{2}$–$\frac{2}{3}$ as long as aedeagus, extending anteriorly from the base of the aedeagus for about $\frac{1}{4}$–$\frac{1}{3}$ of distance to apex of the basal membranous area ; apex of sheath without membranous extension. Area from base of sheath to tip of aedeagus with 20–30 (average 25) sensilla ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (76–95, average 84 μ long), penial sheath and basisternum longer, the ratios being 1 : 3·8–4·5 (average 4·2) and 1 : 1·84–2·25 (average 2·10) respectively.

Material examined : 10 specimens, collected by M. S. K. Ghauri on *Taxus baccata* L. at Imperial College Field Station, Silwood Park, Sunninghill, Berks., on 5.v.57.

This species is very closely related to *P. corni* (Bouché). The two species can be separated by the number of fleshy pleural setae on the caudal extension of segment VII. In *P. pomeranicum* these setae vary from 4–8 (average 5) and in *P. corni* they vary from 11–14 (average 12), 10–17 (average 15) and 11–25 (average 20) in the specimens from Kazakstan, Warsaw and Belgrade respectively. In addition, the pair of hair-like medial pronotal setae was absent in only one specimen of *P. pomeranicum*, whereas only one medial pronotal seta was present in one specimen of *P. corni* (from Warsaw). The ventral foramen of the scutellum is large in *P. pomeranicum*, its length being half or more than half that of the scutellum, while in *P. corni* it is usually very small, although it was more than half as long as the scutellum in one specimen from Belgrade. The posteromedian part of the post-ocular ridge is usually weak in *P. pomeranicum*, but strong in *P. corni*.

CEROPLASTES

Ceroplastes berliniae (Hall)

(Text-figs. 41 and 42)

A short, robust species, with comparatively short antennae and moderately long legs ; with numerous setae covering the body and appendages. When mounted, total body length 1450–1610 (average 1529) μ ; width at mesothorax 360–400 (average 372) μ. Wing expanse 2170–2310 (average 2277) μ.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated, with anterodorsal bulge not pronounced ; length from apex to pronotal ridge 201–232 (average 217) μ, width across genae 201–224 (average 213) μ. *Median crest* sclerotized, showing distinct polygonal reticulation which enclose irregular striations ; with numerous (15–27, average 21) fleshy *dorsal head setae* and 4–10 (average 8·1) hair-like ones. *Midcranial ridge* dorsally absent ; ventrally strong, reaching ocular sclerite posteriorly, surrounding area weakly polygonally reticulated. *Genae* large, sclerotized, with polygonal reticulation ; each with 9–18 (average 14) fleshy and 2–7 (average 4·4) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 23–27 (average 25) μ in diameter and 1·8–2·7 (average 2·2) times as much apart ; those of the ventral eyes 25–27 (average 26) μ in diameter and 0·6–1·0 (average 0·7) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized and polygonally reticulated throughout. *Preocular ridge* extending only a very short distance below articular process. *Postocular ridge* well developed throughout ; dorsal and ventral to ocellus the ridge usually splits up with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 0–4 (average 2) f.s. and occasionally one h.s. on each side. *Ventral head setae* consisting of 47–67 (average 53) f.s. and 3–8 (average 4·4) h.s., scattered over the ocular sclerite, always with some (2–7, average 4·8) f.s. occurring in front of this sclerite and with

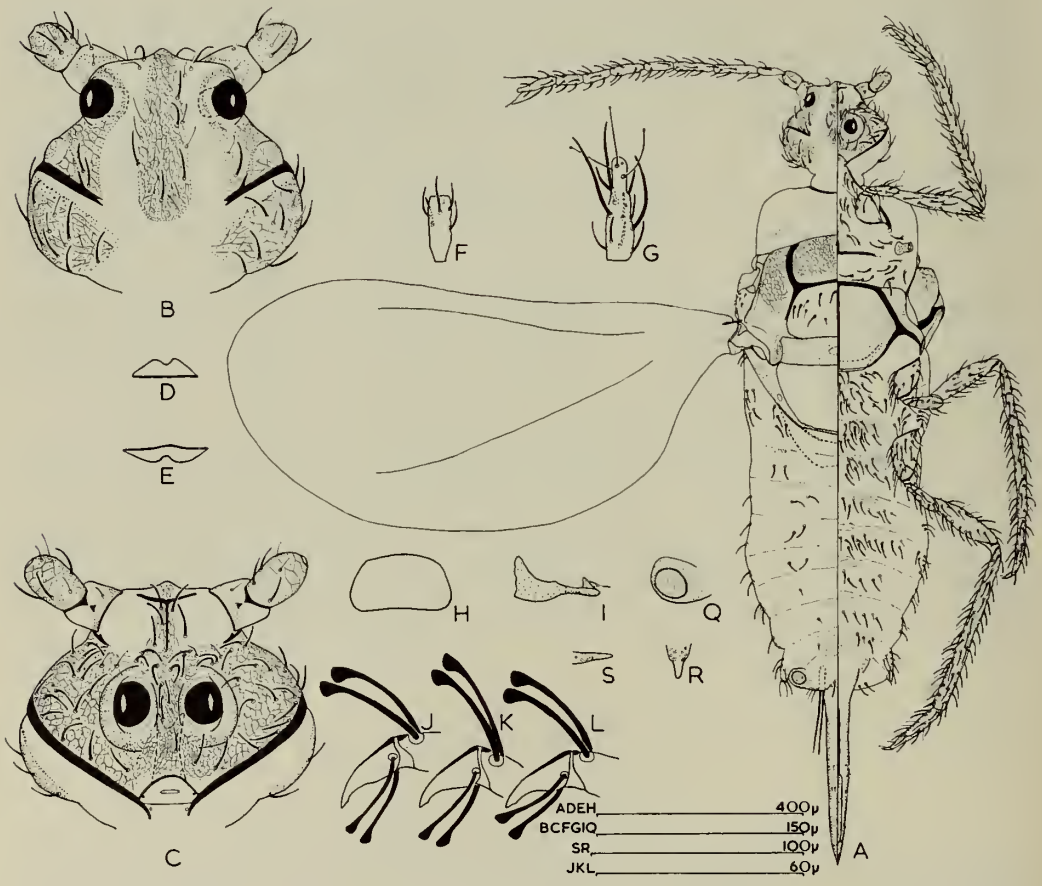


FIG. 41. *Ceroplastes berliniae* Hall, dorsal and ventral view.

5–9 (average 7·1) between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex deeply bifurcate, extending to around level of posterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 541–673 (average 622) μ long, i.e. shorter than half body length (ratio 1 : 2·39–2·54, average 2·46), shorter than posterior leg (ratio 1 : 0·68–0·74, average 0·71) and longer than penial sheath (ratio 1 : 1·43–1·64, average 1·55). *Scape* 38–42 (average 40) μ long and 34–40 (average 37) μ wide, with 3 h.s. *Pedicel* with distinct, polygonal, dorsal reticulation ; 48–53 (average 50) μ long and 27–30 (average 29) μ wide ; with 6–8 (average 7·1) f.s., 3–5 (average 4·3) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 2·2–2·8 (average 2·5) times longer than wide (44–53, average 49 μ long and 19–23, average 20 μ wide) ; with 4–8 (average 6·2) f.s. of medium length, 1·0–1·4 times longer than width of segment ; with 1·4 usual sensilla basiconica. *Segments* IV–IX cylindrical ; length of these segments (in μ) 80–103 (average 90), 68–89 (average 78), 46–65 (average 57), 60–76 (average 65), 53–63 (average 58) and 46–57 (average 52) respectively, widths varying from 15 to 23 μ, with distal segments slightly wider than proximal ones ; with 11–19 (average 15), 13–22 (average 17), 9–17 (average 13), 12–20 (average 15), 12–14 (average 13), 11–15 (average 13) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal ⅓ constricted ; 74–93 (average 82) μ long and 20–23 (average 21) μ wide (near base) ; carrying 5–7 (average 5·8) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about as long as the segment and the 2 shorter ones about as long as the f.s. (but stouter) ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 498–555 (average 540) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : occasionally one f.s. present behind pronotal sclerite. *Post-tergites* relatively large, with irregular striations and without setae. *Pleural structures* typical of family. *Sternum* with strong transverse ridge, median ridge represented by a weak basal stalk, and triangular sclerite narrow and very weakly sclerotized. *Anteprosternal setae* : 2–7 (average 4·3) f.s. on each side, with usually one f.s. situated dorsal to proepisternum + cervical sclerite ; *prosternal setae* : 27–39 (average 32) f.s., scattered over the sternal area and often spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with moderately deep emargination. *Prescutum* more than twice as wide as long (average 197 and 85 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; medially with slightly more heavy sclerotization becoming ridge-like anteroventrally ; with distinct polygonal reticulation. *Scutum*. *Median membranous area* subrectangular ; 99–112 (average 103) μ long and 1·69–1·94 (average 1·80) times as wide (width 175–199, average 188 μ) ; with 10–20 (average 14) f.s. and 4–14 (average 10) h.s. *Scutellum* 53–65 (average 60) μ long and 190–209 (average 200) μ wide, the ratio being 1 : 3·0–3·8 (average 3·4) ; tubular, with small ventral foramen ; without setae. *Postnotum* reticulated, with anterior margin irregular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and with 1–3

FIG. 42. *Ceroplastes berliniae* Hall, lateral view; also referable for lateral view of *Ceroplastes* sp.

(average 1·7) fleshy *postalary setae* occurring on or immediately posterior to it. *Mesopostphragma* with deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* absent. *Subalare* small. *Episternum* distinctly polygonally reticulated ; *subepisternal* ridge well developed, but below membranous cleft indistinct and only marked by a band of dark sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 223 μ wide and 171 μ long, i.e. 1·48–1·77 (average 1·65) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* : 18–29 (average 24) f.s., arranged in a band behind the spiracles and prosternum. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 4–8 (average 6·3) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Additional sclerite* small. *Antemetaspiracular setae* : 1–5 (average 2·7) f.s.

Metathorax. *Metanotum* with thickening of posterior margin desclerotized medially ; *suspensorial sclerites* absent. *Postnotum* consisting of two small sclerites, one on each side. *Metatergal setae* : 2–7 (average 3·6) f.s. on each side but no h.s. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 3–9 (average 5·5) f.s. *Postmetaspiracular setae* : 12–16 (average 14) f.s. and 0–2 (average 0·6) h.s. *Metasternal plate* weak and irregular, but more heavily sclerotized anteriorly. *Anterior* and *posterior metasternal setae* : 36–48 (average 41) and 18–29 (average 23) f.s. respectively.

Wings hyaline; short (length 920–980, average 968 μ) and comparatively broad (width 450–480, average 465 μ), the ratio width to length being 1 : 2·00–2·18 (average 2·08) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs moderately long, and slender, with fore pair shortest and hind pair longest ; ratio length of hind leg to body length is 1 : 1·75–1·86 (average 1·79). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	49–61	68–76	186–205	289–325	106–122	21–23	724–798
	(54)	(73)	(197)	(310)	(113)	(22)	(770)
II	65–74	80–89	158–175	304–338	112–125	20–23	744–813
	(70)	(84)	(166)	(319)	(119)	(22)	(780)
III	76–84	89–95	175–186	338–365	122–133	22–24	825–876
	(80)	(92)	(180)	(352)	(127)	(23)	(854)

Coxae : with 8–13 (average 11), 13–22 (average 16) and 20–29 (average 24) f.s., and 6–10 (average 8·2), 9–14 (average 11) and 14–17 (average 15) h.s. on the fore, middle and hind coxa respectively ; fore coxa without coxal bristles ; apical seta about ⅔ as long as trochanter. *Trochanters* 23–34 μ wide ; with 6 oval sensilla ; with 9–14 f.s. on the fore and middle trochanter and 15–24 (average 19) on the hind one, and each with 6–10 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and a long apical seta which, on the fore trochanter, is 1·32–1·77 (average 1·52) times as long as the width of trochanter. *Femora* of medium width (37–45 μ), with ratio width to length of hind femur 1 : 4·1–4·4 (average 4·2) ; with 24–35 f.s. and 8–16 h.s. *Tibiae* 19–27 μ wide ; ratio width to length of hind tibia 1 : 12·8–15·9 (average 14·3) ; each with 81–111 setae of which 21–30 are h.s. and 58–83 f.s., the latter about 1½ times longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 17–21 μ wide, hind tarsus 6·4–6·6 (average 6·5) times longer than wide ; each with 17–27 f.s. and 6–11 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 380–450 (average 409) μ long and 330–380 (average 345) μ wide.

Segments I–VII : *tergites* represented by a small transverse sclerite on each side on anterior margin of segments II–III and a weak transverse plate on VI–VII ; *sternites* represented by a

weak transverse plate on segments II, III, VI and VII. *Caudal extension* of segment VII large, reaching the level of the posterior margin of segment VIII, tapering and weakly sclerotized. *Dorsal setae* : up to 4, 5, 6, 3, 2 and 1 f.s. on segments I–VI respectively, but none on VII ; occasionally a single h.s. present on segments I–III, and usually one on each side on each of segments IV–VII. *Pleural setae* consisting of *dorsopleural setae* : 0–3 (average 0·7), 0–3 (average 1·3), 0–3 (average 1·7), 1–3 (average 2), 0–3 (average 1·6) and 0–4 (average 1) f.s. on I–VI, and 0–2 (average 0·9), 2, 0–2 (average 1·6) and 1–2 (average 1·7) h.s. on segments III–VI respectively, and of *ventropleural setae* : occasionally one (range 0–2) f.s. on II, usually 2 (range 0–3) on III, and 3 (range 1–5) on each of segments IV–VI, and usually one h.s. on each of segments IV–VI. Segment VII with 9–15 (average 12) f.s. and 3–4 (average 3·2) h.s. ; some of the posterior h.s. usually longer than rest. *Ventral setae* : 21–28 (average 25), 17–25 (average 21), 11–18 (average 14), 7–12 (average 10), 5–8 (average 7) and 1–5 (average 3) f.s. on the segments II–VII respectively ; usually one h.s. on each side on III–VI and 4 on VII.

Segment VIII with weak tergite and transverse sternite ; caudal extension forming a prominent, weakly sclerotized, semi-circular lobe with a large cicatrix posterodorsally, the latter weakly sclerotized and reticulated in the middle ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 3–4 times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : 0–3 (average 1·9) f.s. Posterior margin with 2–6 (average 3·8) f.s. and 2–3 (average 2·9) h.s. on each side.

Genital segment. *Penial sheath* long, about ⅔–¾ total body length (ratio 1 : 3·6–4·1, average 3·8), 395–410 (average 4·2) μ long and 38–42 (average 40) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about equal to that of aedeagus, extending anteriorly from base of the aedeagus for about ⅔ of the distance to apex of the basal membranous area ; apex of sheath with a distinct, finger-like membranous extension. Area from base of sheath to tip of aedeagus with 17–22 (average 20) small setae ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* of medium length (118–137, average 125 μ long), penial sheath and basisternum longer, the ratios being 1 : 3·0–3·4 (average 3·1) and 1 : 1·28–1·52 (average 1·39) respectively.

Material examined : 10 specimens, collected on *Brachystegia tamarindoides* Welw. by R. Boulton in the Salisbury district, [Southern] Rhodesia on 11.xii.62 ; received from J. Munting ; identified by D. J. Williams.

Ceroplastes sp.

(Text-figs. 43 and 42)

A short, robust species, with comparatively short antennae and long legs ; with numerous setae covering the body and appendages. When mounted, total body length 1430–1670 (average 1529) μ ; width at mesothorax 370–410 (average 386) μ. Wing expanse 2320–2500 (average 2417) μ.

Head subconical in dorsal view ; in lateral view dorsoventrally elongated, with anterodorsal bulge not pronounced ; length from apex to pronotal ridge 205–247 (average 225) μ, width across genae 213–251 (average 231) μ. *Median crest* sclerotized, showing distinct, polygonal reticulation which does not enclose irregular striations ; with numerous (16–27, average 22) fleshy *dorsal head setae* and 7–11 (average 8·1) hair-like ones. *Midcranial ridge* dorsally represented by a short, vestigial ridge on anterior margin of head ; ventrally strong, reaching ocular sclerite posteriorly, surrounding area weakly polygonally reticulated. *Genae* large, sclerotized, with polygonal reticulation ; each with 11–19 (average 15) fleshy and 2–7 (average 4·3) hair-like *genal setae*. *Eyes* : two pairs, subequal ; corneae of dorsal eyes 27–30 (average 29) μ in diameter and 1·6–2·6 (average 2·1) times as much apart ; those of the ventral eyes 29–32 (average 30) μ in diameter and 0·6–1·0 (average 0·8) times as much apart. *Ocellus* small. *Ocular sclerite* well sclerotized, polygonally reticulated throughout. *Preocular ridge* extending

a very short distance below articular process. *Postocular ridge* well developed throughout ; ventral to ocellus the ridge usually splits up, with the anterior branch partly surrounding ocellus. *Interocular ridge* absent. *Dorsal ocular setae* : 1–4 (average 2·5) f.s. and 1–5 (average 2·8) h.s. *Ventral head setae* : 55–84 (average 71) f.s. and 4–8 (average 6·3) h.s., scattered over the ocular sclerite, always with some (3–6, average 2·3) f.s. occurring in front of the sclerite and with 11–21 (average 16) between and behind the eyes. *Preoral ridge* present. *Tendon-like apodeme* long. *Cranial apophysis* of medium length ; apex bifurcate, extending to around level of posterior margin of ventral eyes. *Mouth opening* irregular. *Anterior tentorial pits* absent.

Antennae 10-segmented, filiform ; 678–770 (average 727) μ long, i.e. shorter than half body length (ratio 1 : 2·02–2·24, average 2·10), shorter than posterior leg (ratio 1 : 0·72–0·78, average 0·75) and longer than penial sheath (ratio 1 : 1·59–1·80, average 1·71). *Scape* 42–46 (average 43) μ long and 38–42 (average 39) μ wide, with 3 h.s. *Pedicel* occasionally with polygonal reticulation dorsally, but usually with only wavy striations ; 46–53 (average 50) μ long and 34–47 (average 38) μ wide ; with 8–17 (average 12) f.s., 4–6 (average 5·4) h.s. and a sensillum placodeum. *Segment* III somewhat club-shaped, 2·6–3·2 (average 3) times longer than wide (59–72, average 69 μ long and 21–25, average 23 μ wide) ; with 8–15 f.s. of medium length, 1·2–1·4 (average 1·3) times longer than width of segment ; with 1–3 usual sensilla basiconica. *Segments* IV–IX cylindrical ; lengths of these segments (in μ) 106–137 (average 120), 91–105 (average 98), 68–80 (average 74), 68–87 (average 79), 49–65 (average 58) and 53–65 (average 59) respectively, widths varying from 15 to 23 μ, with distal segments slightly wider than

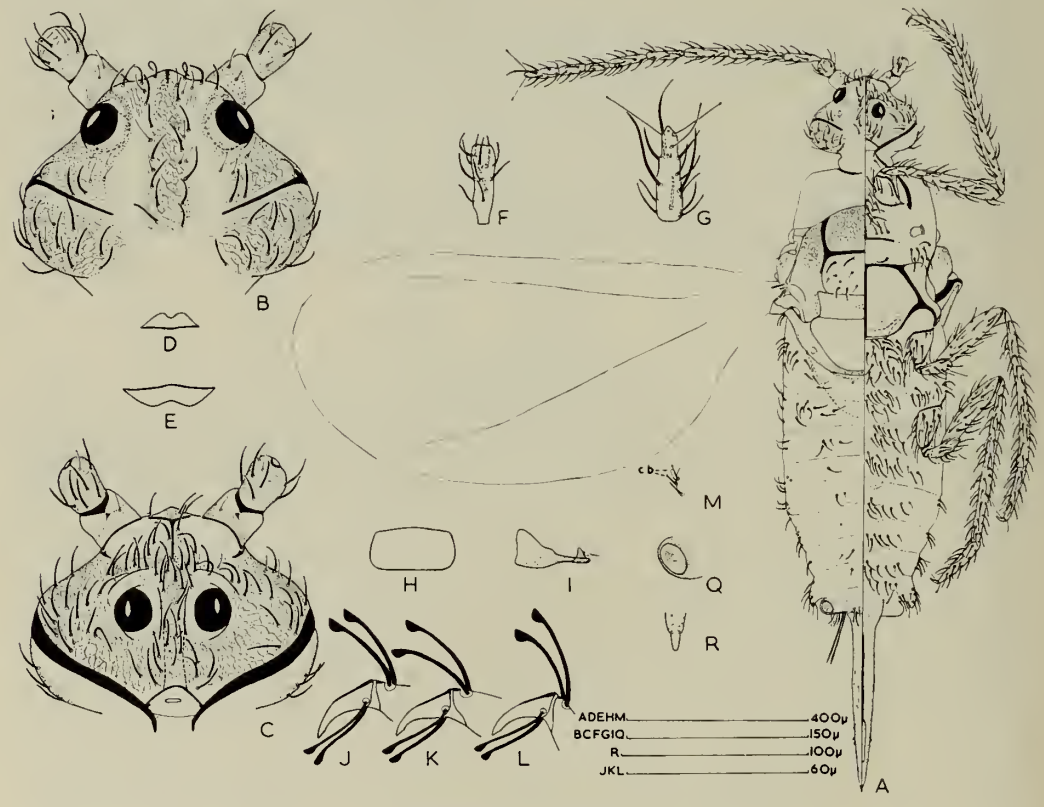


FIG. 43. *Ceroplastes* sp., dorsal and ventral view.

proximal ones ; with 23–29 (average 26), 20–27 (average 23), 13–24 (average 19), 17–23 (average 21), 14–20 (average 17) and 12–17 (average 15) f.s. respectively, but no h.s. ; *antennal bristles* on segments VIII–IX distinctly larger than f.s. *Segment* X : terminal $\frac{1}{3}$ constricted ; 65–84 (average 78) μ long and 19–23 (average 21) μ wide (near base) ; carrying 2–11 (average 7·8) f.s., 3 capitate *subapical setae* and 5 *antennal bristles* of which the 3 long ones are about $\frac{4}{5}$ as long as the segment and the 2 shorter ones about as long as f.s. (but stouter) ; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax 498–593 (average 531) μ long.

Prothorax. *Pronotal ridge* strong, but medially interrupted by weak sclerotization. *Lateral pronotal sclerites* small, without setae. *Medial pronotal setae* : occasionally one f.s. behind pronotal sclerites. *Post-tergites* relatively large, with irregular striations, without setae. *Pleural structures* typical of family. *Sternum* with transverse ridge strong, median ridge represented by a weak basal stalk, and triangular sclerite narrow and weakly sclerotized. *Anteprosternal setae* : 2–5 (average 3·5) f.s. on each side, with no setae occurring dorsal to proepisternum + cervical sclerite ; *prosternal setae* : 14–24 (average 19) f.s. and occasionally one h.s., scattered over the sternal area but not spreading into the area anterior to the spiracles.

Mesothorax. *Mesoprephragma* with moderately deep emargination. *Prescutum* about twice as wide as long (average 196 and 96 μ respectively) ; anterior margin curved ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture* ; medially with somewhat more heavy sclerotization becoming ridge-like anteroventrally ; with distinct polygonal reticulation. *Scutum*. *Median membranous area* subrectangular ; 80–99 (average 91) μ long and 1·75–2·14 (average 1·99) times as wide (width 160–209, average 180 μ), with 2–11 (average 6·7) f.s. and 9–12 (average 11) h.s. *Scutellum* 46–65 (average 55) μ long and 175–198 (average 188) μ wide, the ratio being 1 : 3·1–4·1 (average 3·5) ; tubular, with small ventral foramen ; without setae. *Postnotum* reticulated, with anterior margin irregular and exposed ; *postnotal apophysis* and *postalare* well developed, the latter densely reticulated distally and with 1–6 (average 3·3) fleshy *postalary setae* occurring on or immediately posterior to it. *Mesopostphragma* with moderately deep emargination. *Mesopleuron*. *Mesopleural ridge* strong, not interrupted above coxal articulation ; *pleural apophysis* and *pleural wing process* well developed. *Basalare* absent. *Subalare* small. *Episternum* distinctly polygonally reticulated ; *subepisternal ridge* well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. *Epimeron* small. *Lateropleurite* partly bounded anteriorly by an extension from marginal ridge. *Basisternum* large, about 232 μ wide and 158 μ long, i.e. 1·60–1·88 (average 1·74) times longer than membranous area of scutum ; with strong median ridge and bounded by strong *marginal* and *precoxal ridges* ; without setae. *Furca* well developed. *Mesothoracic spiracle* with well developed peritreme ; *postmesospiracular setae* : 14–29 (average 21) f.s. and occasionally one h.s., arranged in a group behind each spiracle and a small number posterior to prosternum. *Tegula* small, membranous bulge with a small weak sclerite posteriorly and with 3–10 (average 5·7) h.s. *Third axillary wing sclerite* with a pronounced ventral projection at its base. *Antemetaspiracular setae* : 2–7 (average 4·1) f.s.

Metathorax. *Metanotum* with thickening of posterior margin desclerotized medially ; *suspensorial sclerites* absent. *Postnotum* consisting of two small sclerites, one on each side. *Metatergal setae* : 1–6 (average 2·9) f.s. and sometimes up to 3 (0–3, average 0·8) h.s. of which one is occasionally situated more medially than the others. *Pleural ridge* considerably reduced, extending only a short distance above coxal articulation. Vestigial *precoxal ridge* present. *Episternum* reduced to a small subtriangular plate ; *epimeron* produced posteriorly. *Metathoracic spiracle* similar to mesothoracic one. *Dorsospiracular setae* : 9–18 (average 15) f.s. *Postmetaspiracular setae* : 13–19 (average 16) f.s. and 1–3 (average 1·6) h.s. *Metasternal plate* weak and irregular, but more heavily sclerotized anteriorly. *Anterior* and *posterior metasternal setae* : 41–66 (average 54) and 20–46 (average 33) f.s. respectively.

Wings hyaline ; short and comparatively broad : 970–1060 (average 1018) μ long and 445–500 (average 483) μ wide, the ratio width to length being 1 : 2·04–2·18 (average 2·11) ; *alar lobe* and *alar setae* absent. *Halteres* absent.

Legs long and slender, with the fore pair usually shortest and the hind pair longest ; the ratio length of hind leg to body length is 1 : 1·54–1·69 (average 1·61). Length of segments (in μ) :

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57–65	70–78	220–247	323–376	124–131	24–27	827–928
	(62)	(76)	(231)	(347)	(129)	(25)	(870)
II	68–78	84–95	194–209	346–380	125–137	25–28	849–927
	(75)	(89)	(201)	(363)	(132)	(27)	(885)
III	80–87	91–101	201–220	365–418	133–137	25–27	903–989
	(83)	(98)	(213)	(394)	(136)	(26)	(950)

Coxae : with 14–16 (average 15), 22–30 (average 26) and 30–41 (average 37) f.s. and 7–9 (average 8), 7–11 (average 9) and 12–17 (average 13) h.s. on the fore, middle and hind coxa respectively ; fore coxa with 2–4 (average 3·2) capitate coxal bristles ; apical seta about ½ as long as trochanter. *Trochanters* 23–30 μ wide ; with 6 oval sensilla, 10–17 f.s. and 6–8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1·69–2·31 (average 2·01) times as long as width of trochanter. *Femora* of medium width (38–46 μ), ratio width to length of hind femur being 1 : 4·6–5·3 (average 4·9) ; each with 31–44 f.s. and 12–23 h.s. *Tibia* 19–25 μ wide, ratio width to length of hind tibia being 1 : 16–18 (average 17) ; each with 92–120 setae, of which 19–33 are h.s. and 71–88 f.s., the latter about 1½ times longer than width of tibia ; apical spur about the same size on all tibiae. *Tarsi* 19–22 μ wide, hind tarsus 6·0–6·6 (average 6·4) times longer than wide ; with 20–32 f.s. and 8–16 h.s. ; *tarsal digitules* subequal, slightly longer than claw. *Claws* of medium length, a little longer than width of tarsus ; slightly curved, with small denticle near tip ; *ungual digitules* subequal, about as long as claw.

Abdomen 330–460 (average 399) μ long and 300–360 (average 333) μ wide.

Segments I–VII : *tergites* represented by a small sclerite on each side on anterior margin of segments II–III, and a weak transverse plate on VI–VII ; *sternites* represented by a weak transverse plate on segments II, III and VII. *Caudal extension* of segment VII large, tapering, weakly sclerotized. *Dorsal setae* : 5–14 (average 9) f.s. on I, 1–5 on II and III, and up to 3 on each of segments IV–VII ; occasionally a single h.s. on I–III, and usually one on each side on each of segments IV–VII. *Pleural setae* consisting of *dorsopleural setae* : 2–10 (average 4·4), 1–5 (average 2·9), 1–6 (average 3·2), 0–6 (average 3·2), 2–6 (average 4·1) and 1–4 (average 2·2) f.s. on I–VI, and 0–1 (average 0·3), 1–2 (average 1·6), 1–2 (average 1·7), 1–3 (average 2·1) and 0–2 (average 1·6) h.s. on segments II–VI respectively, and of *ventropleural setae* : up to 5 f.s. on each of segments III–VI, and usually one (range 0–2) h.s. on IV–VI. Segment VII with 12–17 (average 14) f.s. and 3–5 (average 3·4) h.s. ; some of the posterior h.s., usually longer than the rest. *Ventral setae* : 23–35 (average 29), 14–31 (average 23), 12–22 (average 16), 8–14 (average 11), 5–12 (average 9) and 6–11 (average 9) f.s. on segments II–VII respectively ; usually one h.s. on each side on segments III–VI and 4 on VII.

Segment VIII : with weak tergite and transverse sternite ; caudal extension forming a prominent, weakly sclerotized, semi-circular lobe, with a large cicatrix posterodorsally, the latter weakly sclerotized and reticulated in the middle ; *glandular pouch* with 2 long, pointed setae, whose protruding part is 3–3½ times as long as section within pouch. Small IXth tergite present. *Ante-anal setae* : 2–5 (average 3·8) f.s., 0–4 (average 1·6) small h.s. and occasionally one long h.s. Posterior margin with 3–7 (average 4·2) f.s. and 3–4 (average 3·2) h.s. on each side.

Genital segment. Penial sheath long, about $\frac{2}{7}$ total body length (ratio 1 : 3·5–3·8, average 3·6), 407–445 (average 426) μ long and 38–44 (average 40) μ wide ; lateral sclerotizations narrowly joined anterior to anus ; length of *basal rod* about twice that of aedeagus, extending anteriorly from base of the aedeagus for about $\frac{5}{8}$ of the distance to apex of the basal membranous area ; apex of sheath with a distinct, finger-like membranous extension. Area from base of sheath to tip of aedeagus with 23–29 (average 25) small sensilla ; a cluster of small sensilla occurring ventrally near apex of sheath. *Aedeagus* short (87–106, average 95 μ long), penial sheath and basisternum longer, ratios being 1 : 4·1–4·9 (average 4·5) and 1 : 1·53–1·78 (average 1·66) respectively.

Material examined : 10 specimens, collected by J. Munting on *Milletia* sp. in Umkomaas, South Africa, on 7.ii.62 ; no adult females present with the males ; nearby females of *Ceroplastes ?mimosae* Hall occurred on *Abaris* sp. ; identification by D. J. Williams.

This species differs from *C. berliniae* in having coxal bristles on the fore coxa, and a shorter aedeagus (measured, for example, against the basal rod or the penial sheath) and also in a number of less striking characters, e.g. in the presence of a vestigial dorsal part of the midcranial ridge, and in the number of f.s. between and behind the eyes, on antennal segment IV and ventrally on abdominal segment VII.

DISCUSSION

The present study of male Coccidae has revealed a number of interesting facts concerning the taxonomy of this family, including its relationships with other members of the superfamily Coccoidea. Unlike the other larger families of the Coccoidea, such as the Diaspididae or even Pseudococcidae, our knowledge of the intra-family relationship of various forms included in the family Coccidae is very limited. Only very few workers have attempted to classify this large family on the basis of the customary female characters. Steinweden (1929) grouped a small number of genera around each of the three genera *Coccus* L., *Toumeyella* Ckll., and *Exaerotopus* Newst., but left most of the genera studied by him as " ungroupable " ; Šulc (1941) formed the tribe Eriopeltini to include the three genera *Eriopeltis*, *Scythia* and *Mohelnia* (the latter is now regarded as being synonomous with *Scythia* (Borchsenius, 1957)). Bodenheimer (1953) divided the Coccidae of Turkey into four subfamilies, i.e. the Coccinae (including *Coccus*, *Eulecanium*, *Sphaerolecanium*, *Saissetia*, *Pulvinaria* and *Paralecanopsis*), Filippiinae (including *Filippia* and *Euphilippia*) and the Ceroplastinae and Eriopeltinae which include *Ceroplastes* and *Eriopeltis* respectively. The only relatively comprehensive classification, based on a comparatively large number of genera (37) is that of Borchsenius (1957), who divided the family into three subfamilies, the Filippiinae, Coccinae and Ceroplastinae, the Coccinae being further subdivided into two tribes, the Coccini and Pulvinariini. This classification is mainly based on a few characters of the adult female and particular emphasis is put on the way in which the body and eggs are covered.

The male material, 19 genera (23 species) used in the present investigation, included 14 of the 37 genera on which Borchsenius based his classification, representing all his subfamilies and tribes. On an examination of the characters of the males it was immediately apparent that they exhibit entirely different relationships, which do not conform with the division of the family suggested by Borchsenius. A fresh approach was therefore necessary. The large number of characters available (listed in Table I) made some quantitative evaluation of these relationships possible, but detailed statistical analyses such as mentioned by Sneath and Sokal (1962) and fully discussed very recently in their book on numerical taxonomy (Sokal and Sneath, 1963) are beyond the scope of the present work. Therefore genera which appeared to resemble each other, especially in sharing distinct features such as prominent caudal extensions, an interocular ridge, a head with a pronounced

anterodorsal bulge, large numbers of setae, etc., were grouped together. The validity of these groups were then tested by calculating the number of characters shared by the group as a whole, and by pairs of genera from different groups. For the purpose of these calculations all characters were treated as of equal weight and importance. It was found that the family could be divided into four groups of genera, which can conveniently be called the *EULECANIUM* group, the *ERIOPELTIS* group, the *INGLISIA* group and the *COCCUS* group. In the following discussion the references to suprageneric groups refer to these groups and three aspects will be discussed:

(a) the characters which are of taxonomic importance and the levels at which they appear to be valid,

(b) the classification and interrelationships within the family, and

(c) the relationship of this family with other subdivisions of the Coccoidea.

It must be stressed here that only a small number of species were studied. All the statements and conclusions are therefore tentative and some of them are bound to be altered or even abandoned as more information becomes available, particularly because the grouping suggested from a study of the male does not conform with the classification based on the female.

Taxonomic Significance of the Characters

All the characters which appear to be of some taxonomic importance are listed in Tables I–IV. The characters which at this stage of research were found useful for separating the groups of genera, genera and species are discussed below and listed in detail in Table I.

The *size* and *general appearance* show considerable variation within the family. Broadly speaking, the size is characteristic of species or groups of species but the actual size may vary considerably within one species. Thus specimens of *P. corni* from different localities (Poland, Russia and Yugoslavia) showed large differences, e.g. those from Yugoslavia were about $\frac{3}{4}$ the size of those from Poland, the Russian ones being intermediate. Apart from local climatic conditions, this may be due to the effect of the host plant, which has been shown to influence the size of the females of this species (Habib, 1953 ; Kawecki, 1958a) ; Bustshik (1958) suggested that the effect of the host plant caused size variation in males of some Diaspididae, whereas Ghauri (1962), having found males of distinctly different sizes on the same host plant, mentioned genetic polymorphism as a possible cause. The size is therefore considered to be of rather limited significance. The general " hairy " appearance of the body can be used to separate groups of genera.

The Head.

The *shape* of the head is characteristic of groups of genera, thus it is flat in the *ERIOPELTIS* group (Text-figs. 25, 28) and elongated dorsoventrally in all the other groups except Genus *A* (Text-fig. 21) where it is rounded. The peculiar condition where the anterodorsal bulge is pronounced and the medioventral bulge drawn far back, is characteristic of most of the *COCCUS* group (Text-figs. 32–40). The conditions of the ventral part of the *midcranial ridge* separate groups of genera,

being reduced to a greater or lesser degree in the *ERIOPELTIS* and *INGLISIA* groups, but complete in the *COCCUS* and *EULECANIUM* groups ; the absence of the lateral arms separates *E. ?festucae* from all other species. The dorsal part of the midcranial ridge is frequently absent or vestigial and in the latter case it can usually only be seen in well stained preparations, thus it is not particularly useful, but apparently operates on the specific level. The *postoccipital ridge*, which provided a series of characters in the Diaspididae (Ghauri, 1962), is absent in this family. The absence of reticulation on the *median crest* is peculiar to two genera of the *EULECANIUM* group. The degree of development of the *postocular ridge* separates groups of genera, genera and species in so far as it (i) is generally weak and tapering dorsally, but strong in the *COCCUS* group and the genus *Eriopeltis*, (ii) usually forks below the ocellus, except in the *ERIOPELTIS* group and (iii) is reduced posteromedially in some species but not in others. A broad *interocular ridge* is characteristic of the *ERIOPELTIS* group. The *preoral ridge* is absent in the *ERIOPELTIS* group and two genera of the *EULECANIUM* group. The size of the *cranial apophysis* and the shape of its apex show some variation which can be used at the generic and specific level. The number of *simple eyes* is a very distinct and useful character. In the *ERIOPELTIS* and *COCCUS* groups the number is constant (4), but in the *EULECANIUM* group the number varies from 4–10, separating genera. Thus four closely related genera, *Eulecanium*, *Nemolecanium*, *Physokermes* and *Rhodococcus* can easily be separated in having 10, 6, 4 and 8 eyes respectively. This character was suggested to be of generic importance by Newstead (1903), and Šulc (1908) when he defined the genus *Eulecanium* Ckll. and his two new genera *Sphaerolecanium* and *Palaeolecanium*. The large size of the lateral eyes is characteristic of the *INGLISIA* group.

The *setae* of the head provide a number of important characters and their absence or presence in various regions of the head can be used to separate groups of genera. In the *EULECANIUM* and *ERIOPELTIS* groups there are no fleshy dorsal head setae, no setae at all between and behind the ventral simple eyes and no genal setae ; in the *EULECANIUM* group there are also no fleshy ventral head setae. In the *INGLISIA* and *COCCUS* groups there are present fleshy dorsal head setae as well as fleshy ventral head setae, setae between and behind the ventral eyes, and setae on the genae. The number of setae varies individually, but the differences in the ranges of individual variation can be used to separate some species and genera.

The *antennae* provide a number of characters which can be used at the generic and specific levels. These are (i) the length of the antenna in relation to the length of the body, the posterior leg and the penial sheath, (ii) the width of the 2nd segment relative to that of the 1st, (iii) the length of the 3rd segment in relation to its width, (iv) the relative lengths of the 3rd and 10th segments and (v) the shape of the terminal segment. In addition the relative length of the fleshy setae and the antennal bristles, and also the number of subapical setae can be used to separate genera.

The Thorax.

Prothorax. The absence or presence of certain groups of *setae* and *pores* can be used to separate genera ; a reticulated *prosternum* is characteristic of *Coccus hesperidum* and a spinose prosternum of the *INGLISIA* group. The condition of the median ridge of the prosternum varies too much to be of practical use as it may be complete or any section of it reduced within the same species.

Mesothorax. This provides a number of important characters. The shape of the *mesoprephragma,* the condition of the reticulation on the *prescutum* and the size of the membranous area of the *scutum* can be used as supplementary characters to separate genera and species. A tubular *scutellum* is characteristic of the *ERIOPELTIS* and *COCCUS* groups and the two closely related genera *Ctenochiton* and *Filippia.* A *basalare* joins the pleural wing process to the mesepisternum in all the groups except the *COCCUS* group, where this structure is vestigial or absent. The condition of the median ridge of the *basisternum* separates groups of genera, genera and species. As is the case with the head, the *setae* of the mesothorax (and metathorax) provide a number of very useful characters. The number of fleshy and hair-like scutal setae separates certain genera ; the presence of fleshy postmesospiracular setae separates the *COCCUS* and *INGLISIA* groups from the *EULECANIUM* and *ERIOPELTIS* groups ; the setae on the postalare and basisternum can be used to distinguish genera.

Metathorax. The condition of the *metapleural ridge* and *suspensorial sclerites* is correlated with the absence or presence of the halteres (*q.v.*). When the halteres are absent, the metapleuron is reduced and the suspensorial sclerites absent. The presence of antemetaspiracular and dorsospiracular *setae* differentiates the *INGLISIA* and *COCCUS* groups, while the variation in the number and type of postmetaspiracular, anterior metasternal and posterior metasternal setae can be used to differentiate groups and genera.

The *fore wings* vary from being long and narrow in the *ERIOPELTIS* group to short and broad in the *COCCUS* group ; in the *EULECANIUM* group this variation in shape can be used to separate genera. The absence of *halteres* is characteristic of the *ERIOPELTIS, INGLISIA* and *COCCUS* groups and the genera *Phyllostroma* and *Sphaerolecanium.* Šulc (1908) used this characteristic to define genera. The differences in the number of alar and haltere *setae* can be used to differentiate genera.

The characters provided by the *legs* seem to operate on all taxonomic levels. Some characters are constant within one or two of the groups, but differentiate genera and species in others, e.g. (i) the length of the hind leg and the length of the body is subequal in the *ERIOPELTIS* and *INGLISIA* groups, but differences in the ratio between these two measurements separate genera in the *EULECANIUM* group, and the two species of *Pulvinaria* in the *COCCUS* group. (ii) The coxal bristles are absent in the *ERIOPELTIS* group and some of the genera of the *EULECANIUM* group, but they are present in other genera of the *EULECANIUM* group, in the *INGLISIA* group as well as in the *COCCUS* group (except *Ceroplastes*

berliniae). (iii) the total number of setae on the fore tibia and the preponderance of fleshy setae on the hind tibia separate the *COCCUS* and *INGLISIA* groups from the *ERIOPELTIS* group, but only distinguish genera within the *EULECANIUM* group. Other characters are mainly significant at the generic and specific levels, e.g. (i) the relative lengths of the apical setae on the coxa and trochanter, (ii) the shape of the femur, (iii) the size of the apical spur of the fore tibia in relation to those on the other tibiae, (iv) the length of the fleshy setae in relation to the width of the tibia, (v) the number of fleshy setae relative to the number of hair-like setae on the hind tarsus, (vi) the length of the hind tarsus in relation to its width and (vii) the relative length of the hind claw.

The Abdomen.

The *abdomen* and *genitalia* also provide a series of important characters. The number of tergites and sternites usually vary within the group. The absence or degree of development of the *pleural sclerotization*, however, remains constant within the groups. A prominent, tapering *caudal extension* on segment VII is characteristic of the *COCCUS* group. The shape of the caudal extension of segment VIII and the position and size of the cicatrix differentiate the genera of the *COCCUS* group. The number of dorsal abdominal *setae* on certain segments varies somewhat individually, but can be used as a supplementary character to separate genera and species. The length of the setae of the glandular pouch shows considerable differences between species and genera ; in *Luzulaspis luzulae* the pouch itself is absent. The presence of fleshy setae lateral to the glandular pouch is characteristic of the genus *Ceroplastes*. Fleshy pleural setae occur in the *ERIOPELTIS*, *INGLISIA* and *COCCUS* groups and the genus *Sphaerolecanium*, but only in the *COCCUS* group are they present on segments I–III. Fleshy ventral setae are characteristic of the same genera as the pleural setae, but *Sphaerolecanium* differs from the others in that the fleshy setae only occur on segments II and sometimes III ; a large number of fleshy setae on segment VIII is typical of the *INGLISIA* group. The number and arrangement of the hair-like ventral setae can be used as a supporting character to separate genera and species.

The relative lengths of the various structures of the *genital segment* show considerable differences, usually on the generic, but also on the specific level. The following ratios were found useful : (i) length of penial sheath to body length, (ii) length of basal rod to length of aedeagus, (iii) length of aedeagus to length of penial sheath, (iv) length of aedeagus to length of basisternum. A finger-like membranous extension of the apex of the penial sheath is characteristic of the genus *Ceroplastes*.

TABLE I

STATEMENT OF CHARACTERS SEPARATING GROUPS, GENERA AND SPECIES

CHARACTERS	Eulecanium group											Eriopeltis group			Inglisia group	Coccus group							
	E. tiliae	N. abietis	P. piceae	R. spiraeae	P. bituberculatum	P. myrtilli	F. viburni	Ctenochiton sp.	E. pela	Genus A	S. prunastri	Eriopeltis sp.	E. ?festucae	L. luzulae	I. theobromae	C. hesperidum	Genus B	P. ? betulae	P. acericola	P. corni	P. pomeranicum	C. berliniae	Ceroplastes sp.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
General appearance : A. Slender. B. Robust. C. Intermediate.	C	A	← B →		← A →		← C →			← B →		← A →			C	← A →		C	B	← C →		← B →	
Size : A. Small (less than 1620 μ). B. Large (more than 2300 μ). C. Intermediate.	B	← C →			A		← C →		B	← C →		← A →			C	A	←		C	→		A	→
HEAD																							
Head in lateral view : A. Dorsoventrally elongated. B. Flat. C. Rounded.	←				A					C	A	← B →				←			A	→			
A. Anterodorsal bulge pronounced. B. Not so.	←				B						A	←		B	→	←			A	→		B	→
Median crest : A. Polygonally reticulated. B. Not so.	←			A	→		← B →					←			A	←							→
Interocular ridge: A. Present. B. Absent. C. Both conditions possible.	←				B	→				C	B	← A →				←			B	→			
Postocular ridge: A. Dorsally strong. B. Dorsally weak. C. Intermediate.	←		B	→			← C →		← B →			← A →		C	B	←			A	→			
A. Forking below ocellus. B. Not so.	←					A	→					← B →				←			A	→			
A. Degree of sclerotization reduced posteromedially. B. Not so.	A	B	← A →		←		B	→		A		←				B	←				A	← B →	

Midcranial ridge : A. Dorsal part noticeable. B. Dorsal part absent.

A. Ventral part extending far posteriorly. B. Ventral part reduced. C. Both conditions possible.

A. Lateral arms present. B. Lateral arms absent.

On each side ventrally. A. Reticulated and sclerotized B. Reticulated only. C. Not reticulated.

Preocular ridge, ventral part : A. Short. B. Reaching or almost reaching midcranial ridge. C. Intermediate.

Number of simple eyes : A. 4. B. 6. C. 8. D. 10.

Lateral simple eyes (when present) : A. About as big as dorsal ones. B. Distinctly smaller.

Dorsal simple eyes : Distance between eyes (internally) in relation to diameter of cornea (internally) : A. 3 times or less longer. B. 3 - 6 times longer. C. Intermediate.

Ventral simple eyes: Ditto : A. Equal or less. B. Equal or more. C. Intermediate.

Preoral ridge : A. Absent. B. Present.

Ventral sclerite : A. Absent. B. Present.

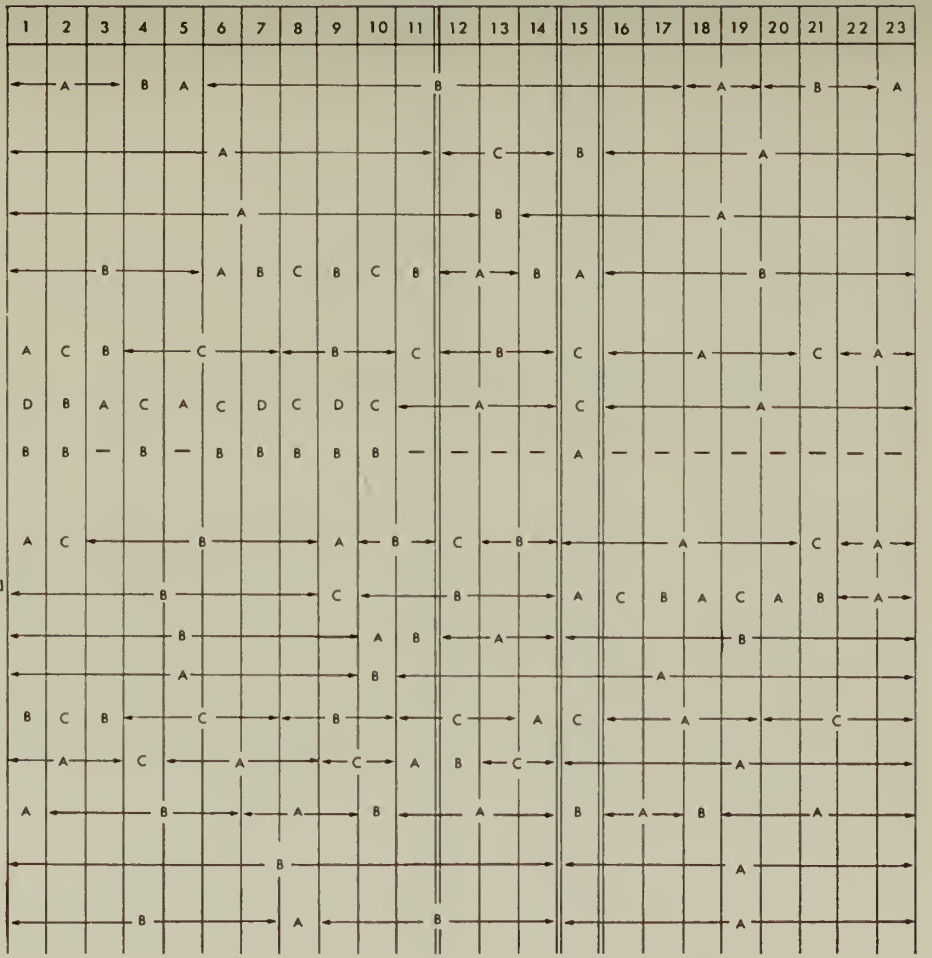
Cranial apophysis: A. Long. B. Short. C. Intermediate.

Apex (central lobe excepting) : A. Bifurcate. B. Trifurcate. C. Truncate.

Genae: A. Polygonally reticulated. B. Not so.

Dorsal head setae : A. Fleshy setae present. B. Fleshy setae absent.

Dorsal ocular setae : A. Present on at least one side. B. Absent.



Ventral head setae : A. Fleshy setae present.
B. Fleshy setae absent.

When present, fleshy setae : A. Less than 35.
B. More than 40.

A. With a pair of median hair-like setae distinctly longer than rest. B. Not so.

A. All the setae situated on or anterior to level of preocular ridge. B. Not so.

A. With setae between and behind ventral eyes (when few, these well behind anterior level of eyes). B. Not so.

Genal setae : A. Present. B. Absent.

When present: A. 11 or less. B. 12 or more.

ANTENNAE

Length in relation to body length : A. More than half. B. Less than half. C. Intermediate.

Length in relation to length of posterior leg :

A. Much longer, ratio 1 : 1.23 - 1.52
A_1 Longer, ratio 1 : 1.05 - 1.22
B. Subequal, ratio 1 : 0.95 - 1.05
C. Shorter, ratio : 1 : 0.58 - 0.93

Length in relation to length of penial sheath:
A. Short, 1.16 - 2.10 times longer. B. Long, 2.10 - 6.10 times longer.

Length of 3rd segment in relation to its width :
A. More than 3 times longer. B. Less than 3 times longer. C. Intermediate.

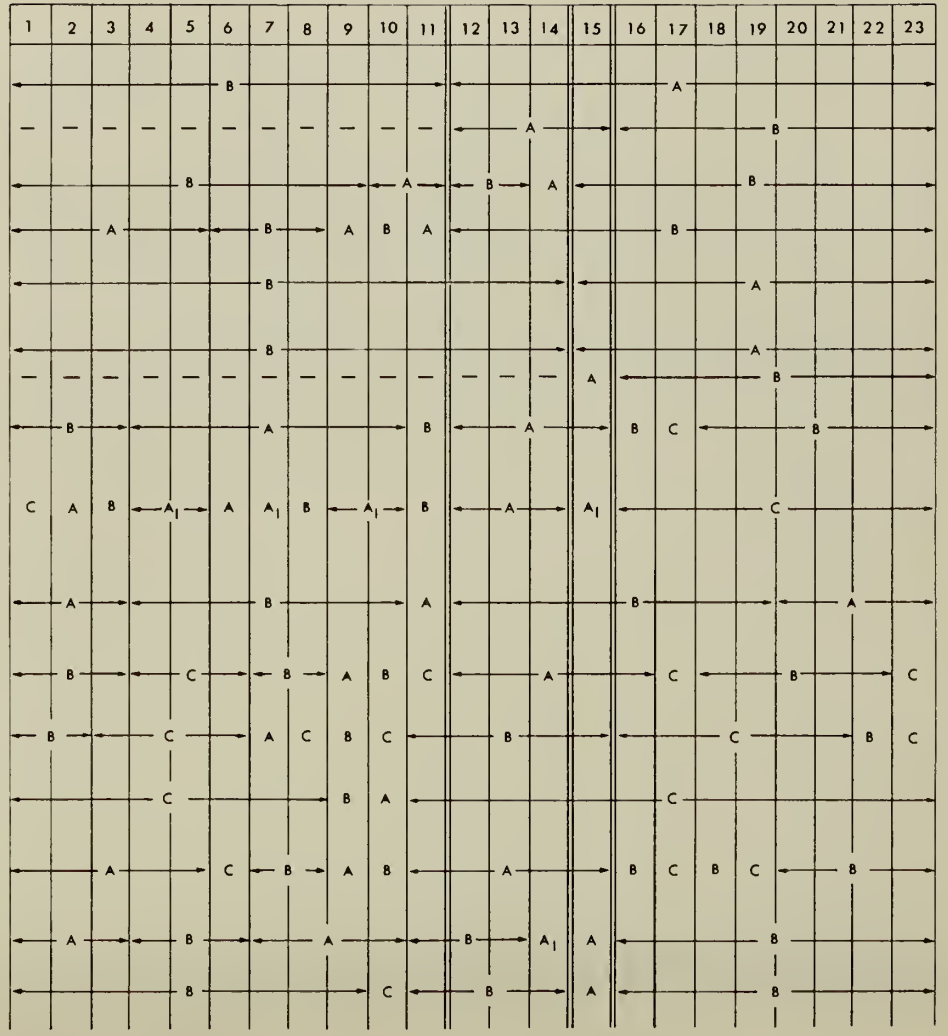
Relative widths of 1st and 2nd segments : A. 2nd wider than 1st. B. 1st wider than 2nd. C. Widths subequal

Fleshy setae on 3rd segment : A. Very short and thick, length less than $\frac{1}{4}$ width of segment. B. Very long, length 4 or more times width of segment. C. Intermediate.

Relative lengths of 3rd and 10th segments : A. 3rd longer than 10th. B. 10th longer than 3rd. C. Either condition possible.

Hair-like setae on 3rd segment : A. Present.
A_1 Usually present. B. Absent.

Number of capitate subapical setae on 10th segment:
A. 2. B. 3. C. 4-6.



Shape of 10th segment : A. Distal part constricted.
B. Not so.

Length of two smallest antennal bristles in relation to length of fleshy setae : A. Distinctly longer.
B. Subequal. C. Shorter.

THORAX
Prothorax:
Circular pores behind pronotal sclerite :
A. Less than 2 on each side. B. 2 or more on each side.

Prosternum : A. Polygonally reticulated. B. Not reticulated. C. Denticulate (spinose).

Medial pronotal hair-like setae : A. Usually 2.
B. Intermediate (1 - 2). C. Usually absent.

Posttergital setae : A. Present on at least one side.
B. Absent.

Prosternal setae : A. Fleshy setae present.
B. Fleshy setae absent.

Mesothorax :

Emargination of mesoprephragma : A. Deep.
B. Shallow. C. Absent.

Reticulation on prescutum : A. Regular polygonal.
B. Irregular. C. Absent or very weak.

Length of membranous area of scutum : A. More than twice width. B. Less than twice width.
C. Intermediate.

Scutellum : A. Not tubular. B. Tubular.

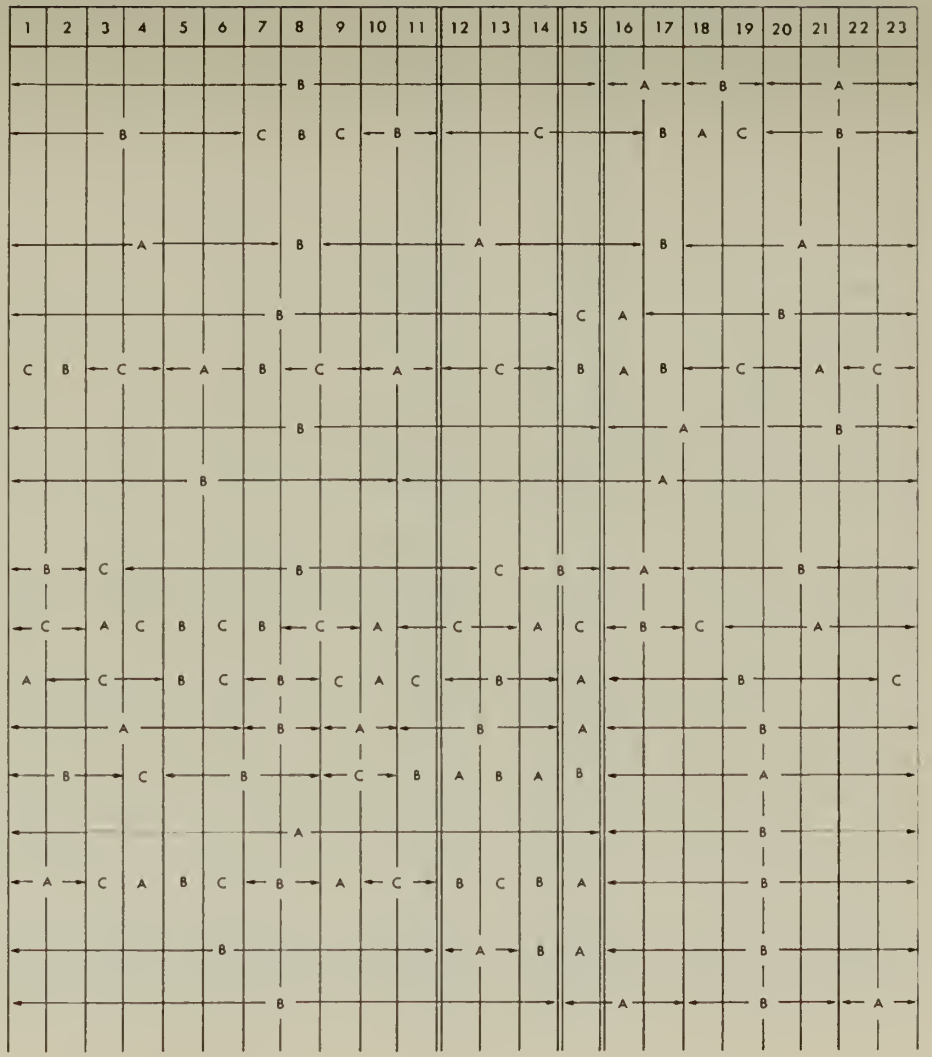
A. 3-4 times wider than long.
B. 2-3 times wider than long.
C. 1-2 times wider than long.

Basalare : A. Joining pleural wing process to mesepisternum. B. Not so.

Length of basisternum in relation to length of membranous area of scutum : A. More than twice as long.
B. Less than twice as long. C. Intermediate.

Median ridge of basisternum : A. Absent or reduced.
B. Complete.

Scutal setae : A. Fleshy setae present.
B. Fleshy setae absent.



A. Hair-like setae absent.
B. Hair-like setae 1-4.
C. Hair-like setae 3-30.

Postalary setae : A. Usually present. B. Absent.

Postmesospiracular setae : A. Fleshy setae present. B. Fleshy setae absent.

A. Fleshy setae 14-32.
B. Fleshy setae more than 43.

Basisternal setae : A. Fleshy setae present. B. Hair-like setae present. C. Setae present.

Metathorax :

Suspensorial sclerite : A. Present. B. Absent.
A. Elongate.
B. Not elongate.

Metapleural ridge : A. Reduced. B. Not reduced

Dorsospiracular setae : A. Fleshy setae present. B. Fleshy setae absent.

Antemetaspiracular setae : A. Present. B. Absent.

Postmetaspiracular setae : A. Fleshy setae present. B. Fleshy setae absent. C. Both conditions possible.

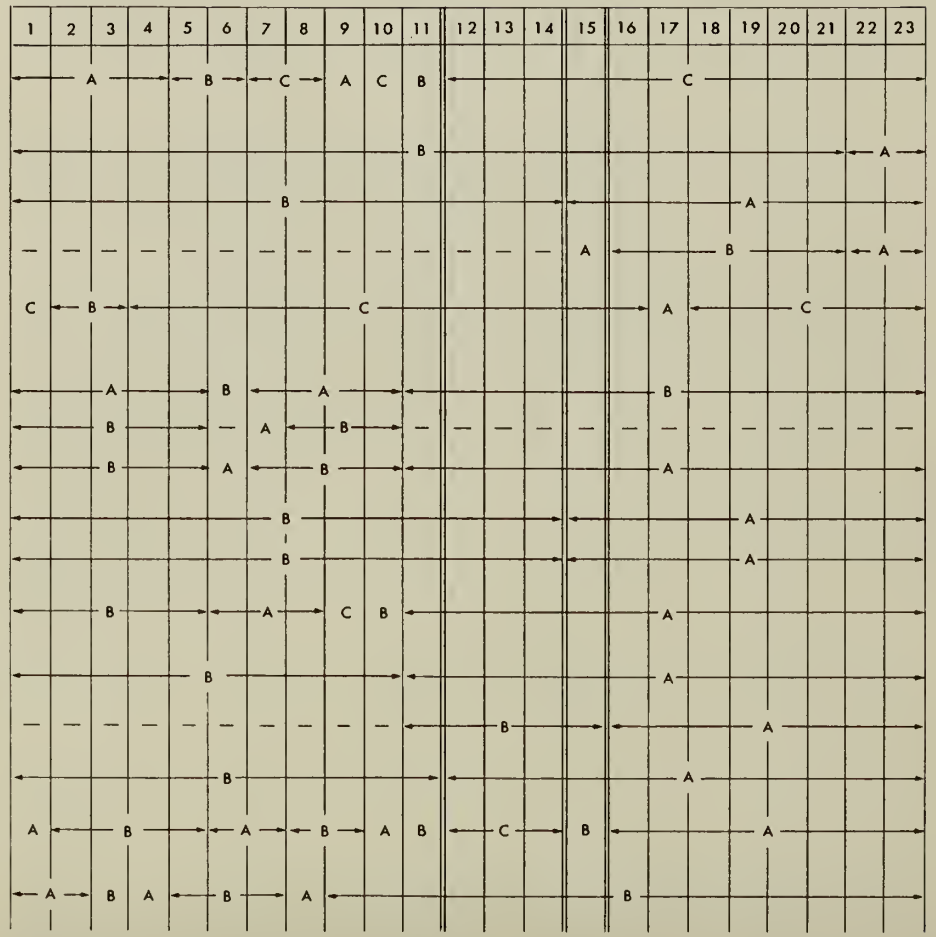
Anterior metasternal setae: A. Fleshy setae present. B. Fleshy setae absent.

A. Fleshy setae numerous (36-94)
B. Fleshy setae less numerous (11-24)

Posterior metasternal setae : A. Fleshy setae more than 4. B. Fleshy setae less than 4.

Fore wings : A. Less than $2\frac{1}{4}$ times longer than wide. B. $2\frac{1}{4}$-$2\frac{3}{4}$ times longer than wide. C. More than $2\frac{3}{4}$ times longer than wide.

Alar setae : A. Present on at least one side. B. Absent.



Halteres : A. Absent. B. Present.

Haltere setae : A. One on each side.
B. More than one on at least one side.

Legs:
Length of hind leg in relation to body length :
A. Body length 1.85 or more times longer.
B. Body length less than 1.85 times longer.

Front coxa : Coxal bristles : A. Present.
B. Absent.

Apical seta : A. Long, about as long as trochanter. B. Short, about half as long as trochanter. C. Intermediate.

Total number of setae on front tibia :
A. More than 60. B. Less than 60.

Length of apical seta on front trochanter in relation to width of trochanter : A. Short, less than $1\frac{1}{2}$ times longer. B. Long, more than 3 times longer. C. Intermediate.

Hind femur : A. Short and wide, less than $3\frac{3}{4}$ times longer than wide. B. Long and narrow, more than 6 times longer than wide. C. Intermediate.

Hind tibia : A. With more fleshy than hair-like setae. B. Vice versa.

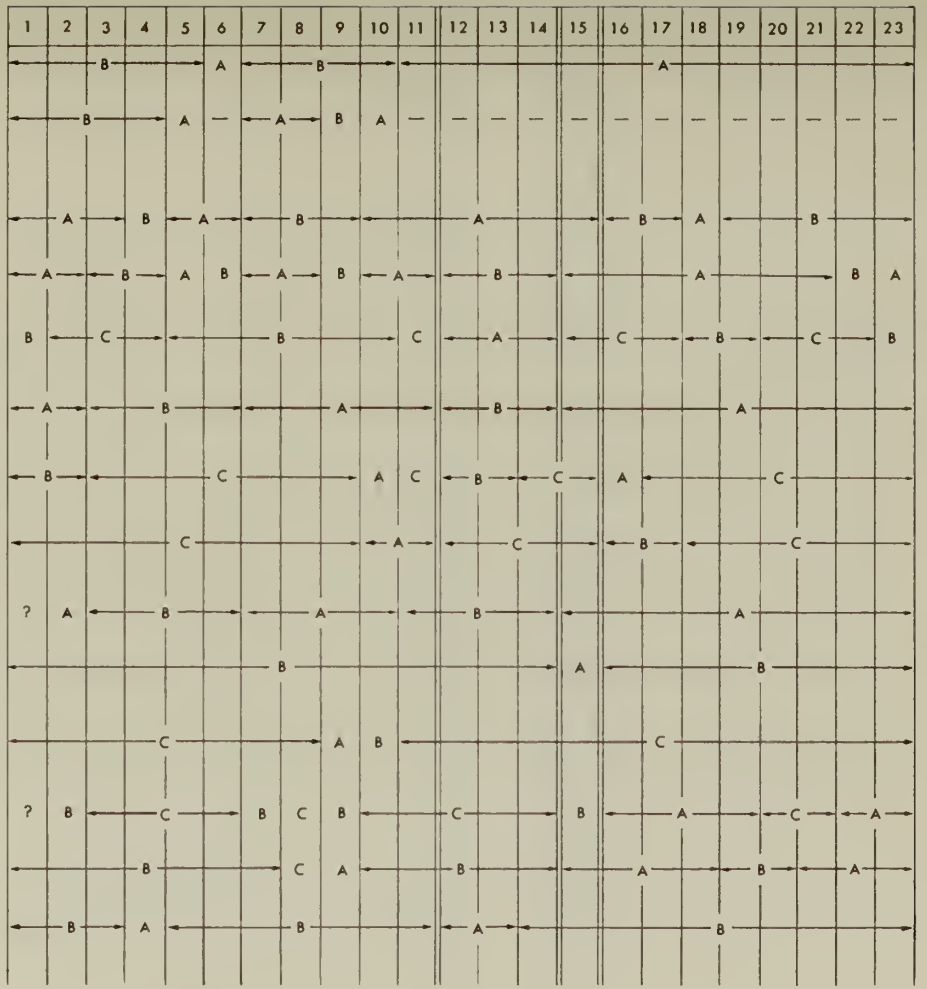
Aptcal spur on tibia : A. On front tibia much smaller than on middle and hind tibiae.
B. Subequal on all tibiae.

Length of fleshy setae in relation to width of tibia:
A. At least 3 times longer. B. Shorter. C. Intermediate.

Hind tarsus : A. With more fleshy than hair-like setae.
B. With subequal numbers of hair-like and fleshy setae. C. With more hatr-like than fleshy setae.

A. More than 6 times longer than wide. B. Less than 6 times longer than wide. C. Intermediate.

Hind claw : A. About $1\frac{1}{2}$ times longer than width of tarsus. B. Equal to or a little longer than width of tarsus.



ABDOMEN

Tergites : A. Present on all the segments.
B. Absent on one or more of the intermediate segments.

Nature of tergites between 1st and 2nd segments:
A. Separate sclerite on each side. B. One sclerite on each side with a separate median sclerite. C. Continuous from side to side.
AC. Both "A" and "C" possible.

Pleural sclerotization :
A. Present on segm. VII..
B. Present on segm.IV-VII. C. Absent.

Sternites : A. Present on segm.II-VIII
B. Absent on one or more of middle segments.
C. Absent on segm. II.

Caudal extensions on segm. VII. A. Very prominent, tapering. B. Small, broadly rounded or slightly pointed.

Caudal extension of segm.VIII forming a :
A. Small convex lobe. B. Papilla-shaped lobe.
C. Large cylindrical lobe. D. Large semi-circular lobe. E. Large geniculate lobe. F. Mammillate lobe.

Cicatrix on caudal extension of segm. VIII :
A. Absent. B. Present.

Location and size of cicatrix : A. Lateral, small.
B. Posterior, large. C. Posterodorsally, large.

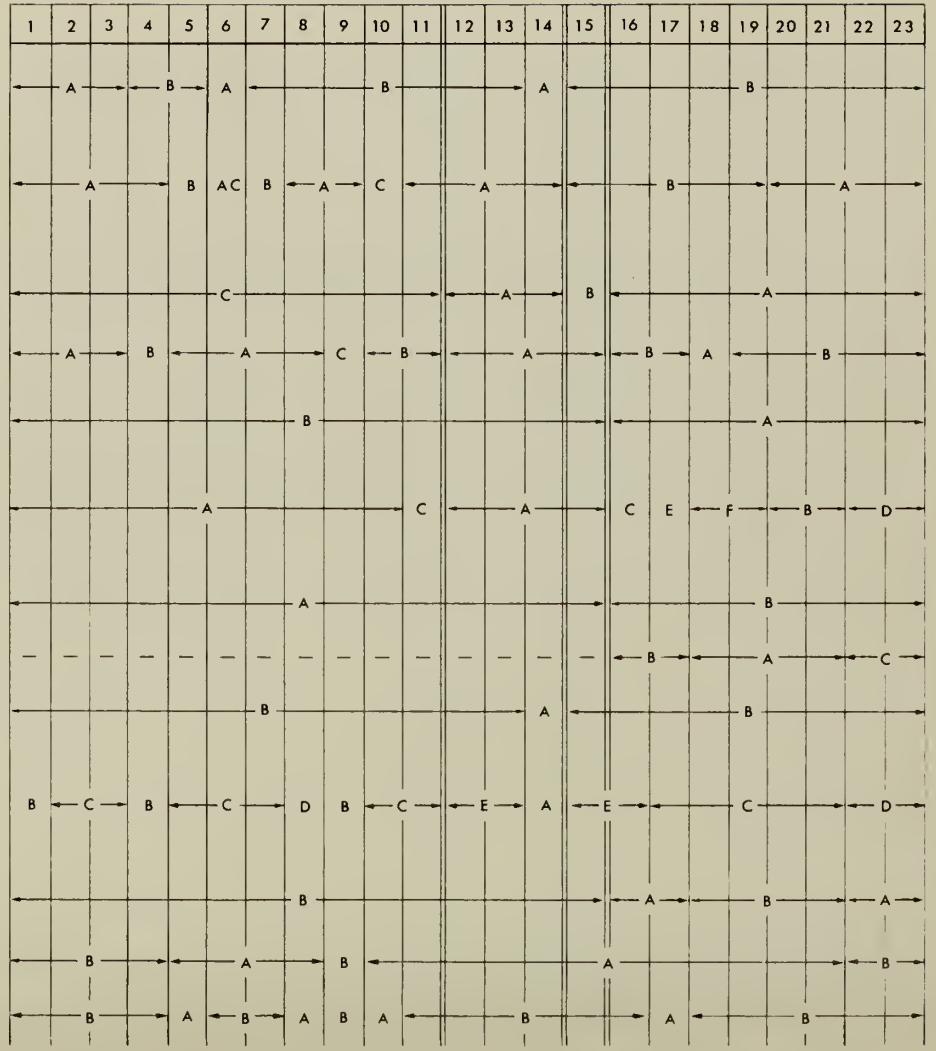
Glandular pouch on segm. VIII : A. Absent.
B. Present.

Setae of glandular pouch : A. With no internal part.
B. With external part less than twice internal part. C. With external part 2-3 times internal part. D. With external part 3-4 times internal part. E. With external part more than 4 times internal part.

Abdominal dorsal setae :
Fleshy setae on segm. I : A. Usually more than one. B. Usually one or none.

Hair-like setae on segm. I : A. Usually 2, rarely 1. B. Usually absent, rarely 1.

Hair-like setae on segm. III : A. Usually 2, rarely 1. B. Usually absent, rarely 1.



Ante-anal setae :

A. Fleshy setae usually present. B. Fleshy setae usually absent.

A. Usually with 2 long hair-like setae.
B. Usually without long hair-like setae.

Lateral to glandular pouch : A. Fleshy setae 2-7.
B. Fleshy setae absent, rarely one.

Circular pores in ante-anal region :
A. One or more present. B. Absent.

Abdominal pleural setae : A. Fleshy setae present.
B. Fleshy setae absent.

A. Present on segm. I-III
B. Absent on segm. I-III

Abdominal ventral setae :
Fleshy setae:
A. Present. B. Absent.

A. Absent posteriorly beyond segm. III.
B. Present posteriorly beyond segm. III.

A. Numerous (7-15) on segm. VIII.
B. Few (3 or less) on segm. VIII.

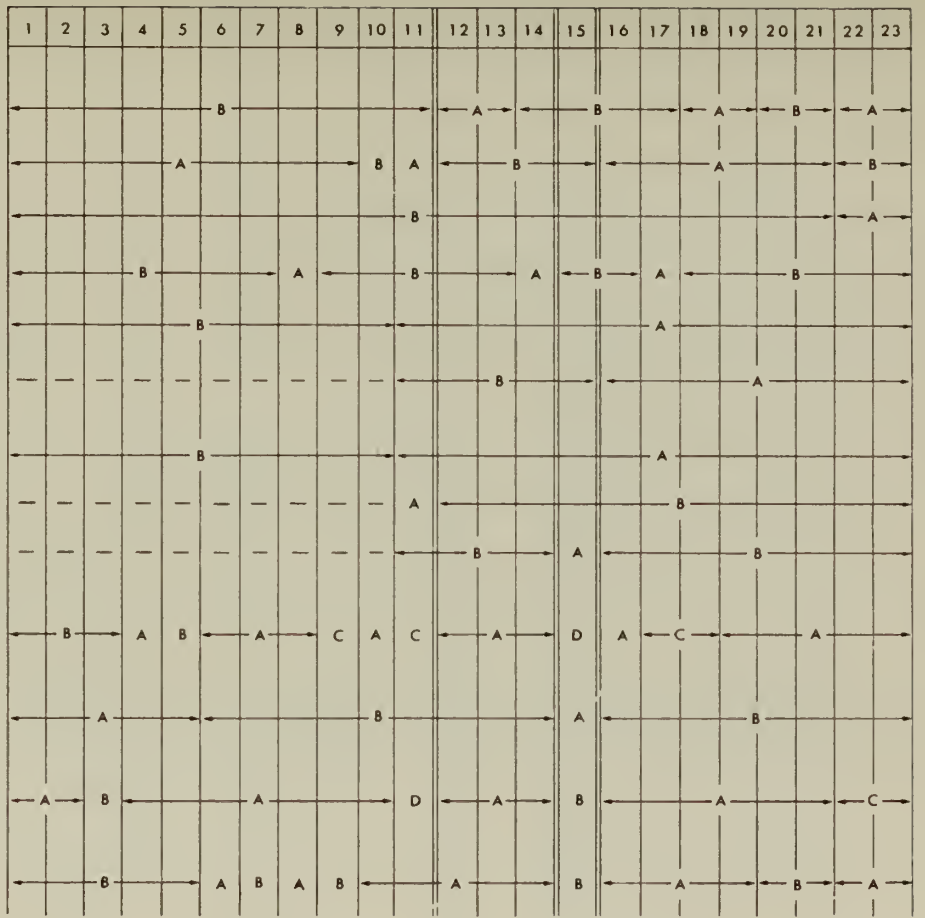
Hair-like setae on segm. II, usually :
A. Absent. B. Two medially.
C. One on each side. D. Two medially and one on each side.

Hair-like setae on segm. III, usually :
A. Two medially, rarely one.
B. None medially, rarely one.

Hair-like setae on segm. VI and VII, usually :
A. 4 setae on both segments. B. 2 setae on both segments. C. 2 setae on segm. VI and 4 on VII. D. 4 setae on segm. VI and 2 on VII.

Lateral sclerotizations of penial sheath :

A. Joined anterior to anus. B. Not so.



Apex of penial sheath : A. Membranously extended. B. Not membranously extended.

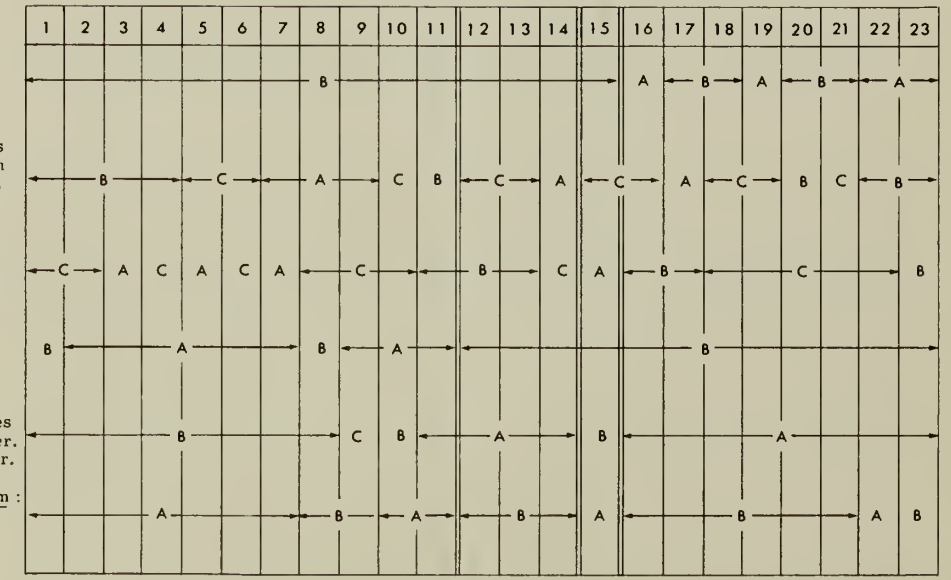
Length of penial sheath in relation to body length : A. Short, body length usually $5\frac{1}{2}$ or more times longer. B. Long, body length usually less than $4\frac{1}{2}$ times longer. C. Intermediate, body length $4\frac{1}{2}$-$5\frac{1}{2}$ times longer.

Length of basal rod in relation to length of aedeagus : A. Short, length less than half aedeagal length. B. Long, length more than $1\frac{1}{4}$ times aedeagal length. C. Intermediate.

Basal rod : A. Anteriorly reaching or almost reaching basal membranous area. B. Not reaching basal membranous area.

Length of aedeagus in relation to length of penial sheath : A. Short, penial sheath more than 3 times longer. B. Long, penial sheath less than 3 times longer. C. Intermediate, penial sheath 2.82-3.22 times longer.

Length of aedeagus in relation to length of basisternum : A. Long, basisternum $\frac{1}{2}$ to $1\frac{1}{2}$ times as long. B. Short, basisternum $1\frac{1}{2}$-4 times as long.



Classification and Interrelationships of the Coccidae based on the Males

Groups of Genera.

A. The characters, which were found from an examination of Table 1 to separate groups of genera, are listed in Table 2. The table contains 34 characters and shows their distribution among the material studied. It will be noticed that a few characters are included of which the alternate conditions occur within the same group (thus only separating genera), but which are of significance in separating other groups. The characters which are exclusive to any particular group are indicated with an asterisk (*) and their total number is given at the end of the table. The number of these characters will be reduced as more information about other members of the family becomes available and it must be stressed here that because of the limited number of species studied the diagnosis and discussion of relationships are very tentative.

To investigate the relationship between groups the method of analysis used by Ghauri (1962) was followed, and the following were calculated :

(a) the number of characters shared by any two groups,

(b) the number of characters exclusive to these two groups, and

(c) the number of characters by which the two groups differ from each other.

The results are given in Table 2 A. The characterization of each group is implicit in Table 2 and given fully in the keys which follow later.

TABLE 2.

LIST OF CHARACTERS WHICH SEPARATE MAJOR GROUPS OF GENERA

Characters	Eulecanium	Eriopeltis	Inglisia	Coccus
HEAD:				
1. In lateral view: A. Flat. B. Dorsoventrally elongated or rounded.	B	A*	B	B
2. Length of antenna in relation to length of posterior leg: A. 1·05 or more times longer. B. Subequal or shorter.	AB	A	A	B
3. Interocular ridge: A. Present. B. Absent.	AB	A	B	B
4. Postocular ridge: A. Forking below ocellus. B. Not so.	A	B*	A	A
5. Midcranial ridge, ventrally: A. Reduced. B. Not so.	B	AB	A	B
6. Number of simple eyes: A. 4. B. More than 4.	AB	A	B	A

TABLE 2. LIST OF CHARACTERS WHICH SEPARATE MAJOR GROUPS OF GENERA

Characters	Eulecanium	Eriopeltis	Inglisia	Coccus
HEAD—*contd.*				
7. Lateral simple eyes (when present): A. About as large as dorsal ones. B. Distinctly smaller.	– B	–	A*	–
8. Pre-oral ridge: A. Absent. B. Present.	AB	A	B	B
9. Fleshy dorsal head setae: A. Present. B. Absent.	B	B	A	A
10. Dorsal ocular setae: A. Present on at least one side. B. Absent.	AB	B	A	A
11. Fleshy ventral head setae: A. Present. B. Absent.	B*	A	A	A
12. Setae between and behind ventral eyes. A. Present. B. Absent.	B	B	A	A
13. Genal setae: A. Present. B. Absent.	B	B	A	A
THORAX:				
14. Prosternum: A. Spinose. B. Not so.	B	B	A*	B
15. Scutellum: A. Tubular. B. Not so.	AB	A	B	A
16. Scutellum: A. 3–4 times as wide as long. B. 1–3 times as wide as long.	B	AB	B	A
17. Fleshy scutal setae: A. Present. B. Absent.	B	B	A	AB
18. Basalare: A. Joining pleural wing process to mesepisternum. B. Vestigial	A	A	A	B*
19. Median ridge of basisternum: A. Complete. B. Reduced or absent.	A	AB	B	A
20. Fleshy postmesospiracular setae: A. Present. B. Absent.	B	B	A	A
21. Antemetaspiracular setae: A. Present. B. Absent.	B	B	A	A
22. Fleshy dorsospiracular setae: A. Present. B. Absent.	B	B	A	A
23. Fleshy anterior metasternal setae: A. More than 36. B. 0–24.	B	B	B	A*

TABLE 2 LIST OF CHARACTERS WHICH SEPARATE MAJOR GROUPS OF GENERA

Characters	Eulecanium	Eriopeltis	Inglisia	Coccus
THORAX—*contd.*				
24. Posterior metasternal setae: A. More than 4. B. Less than 4.	B*	A	A	A
25. Wings: A. Less than $2\frac{1}{4}$ times longer than wide. B. $2\frac{1}{4}$–$2\frac{3}{4}$ times longer than wide. C. More than $2\frac{3}{4}$ times longer than wide.	AB	C*	B	A
26. Total number of setae on front tibia: A. More than 60. B. Less than 60.	AB	B	A	A
27. Hind tibia: A. With more fleshy than hair-like setae. B. With more hair-like setae.	AB	B	A	A
ABDOMEN:				
28. Pleural sclerotization: A. Present on segm. VII. B. Present on segm. IV–VII. C. Absent.	C*	A	B*	A
29. Caudal extensions of segm. VII: A. Very prominent, tapering. B. Small, broadly rounded or somewhat pointed.	B	B	B	A*
30. Cicatrix on caudal extension of segm. VIII. A. Absent. B. Present.	A	A	A	B*
31. Fleshy pleural setae on segm. I–III: A. Present. B. Absent.	B	B	B	A*
32. Fleshy ventral setae: A. Absent posteriorly beyond segm. III. B. Present posteriorly beyond segm. III.	A*	B	B	B
33. Fleshy setae on 8th sternite: A. More than 6. B. Not more than 3.	B	B	A*	B
34. Ventral hair-like setae on segm. III, usually: A. Two setae medially. B. No setae medially.	AB	B	A	B
Total number of exclusive characters	4	3	4	5

TABLE 2 A

Pairs of Groups	Number of Characters (a) shared	(b) of which exclusive	(c) differentiating
Eulecanium-Eriopeltis	14	6	6
Eulecanium-Inglisia	8	1	15
Eulecanium-Coccus	6	1	16
Eriopeltis-Inglisia	9	1	21
Eriopeltis-Coccus	9	2	17
Inglisia-Coccus	16	6	16

1. The *COCCUS* group. To this group have been assigned five genera which appear to be very closely related. They are *Pulvinaria*, Genus *B*, *Coccus*, *Parthenolecanium* and *Ceroplastes*. Pairs of genera share from 75 to 90 characters and the group as a whole has about 60 characters in common. The exclusive characters of this group are (i) the basalare vestigial or absent, (ii) the caudal extension of abdominal segment VII very prominent and tapering, (iii) the presence of a membranous or weakly sclerotized cicatrix on the caudal extension of abdominal segment VII, (iv) the presence of more than 36 fleshy anterior metasternal setae, and (v) the presence of fleshy pleural setae on the first three abdominal segments. In all the genera (except *Ceroplastes*) the shape of the head is rather peculiar in having a pronounced anterodorsal bulge with the medioventral bulge sharply drawn back. Except for this and some other small differences, the males of genus *Ceroplastes* are very similar to those of the other members of this group. This is rather interesting because the females of the genus *Ceroplastes* are considered to be quite distinct and different from the other Coccidae.

The *COCCUS* group is probably the most specialized of the Coccidae, as a comparatively large number (8) of specialized characters are found in it. They are : (i) the presence of only four simple eyes, (ii) the tubular scutellum, (iii) the reduced metathorax, with the episternum small, the pleural ridge short and the halteres lacking, (iv) a basalare which is vestigial and incorporated into the pleural wing process, (v) considerable desclerotization of the abdomen, (vi) the presence of prominent caudal extensions on abdominal segment VII (although reminiscent of the " fleshy tassels " of the Monophlebidae), (vii) the presence on abdominal segment VIII of caudal extensions of various shapes which bear a membranous or weakly sclerotized cicatrix, and (viii) the presence of pleural sclerotization on abdominal segments VII–VIII. (This does not occur in the more primitive Coccoidea, nor in what is regarded as the more primitive members of this family.)

From a study of limited material of *Akermes andersoni* Newst., the drawings and descriptions of *Chloropulvinaria aurantii* (Ckll.) by Borchsenius (1957) and *Neopulvinaria imeretina* Hadz. by Hadzibejli (1955), and the drawing of the posterior part of the abdomen of *Saissetia nigra* (Nietner) by Green (1904–1909) it seems certain that the genera *Akermes*, *Chloropulvinaria*, *Neopulvinaria* and *Saissetia* should also be included in this group.

2. The *INGLISIA* group comprises only the genus *Inglisia*, which shows a number of distinctive characters justifying its separation from all other groups. A brief study of a species of *Ceroplastes* (*C. chiton* Green) showed that this species also belongs to the *INGLISIA* group. The exclusive characters of the group are the following : (i) lateral eyes about as large as the dorsal and ventral ones, (ii) prosternum spinose, (iii) pleural sclerotization extending from the IVth–VIIth abdominal segments, (iv) more than 6 fleshy setae on abdominal sternite VIII.

The group features a number of primitive and specialized characters. The specialized ones are : (i) the considerably reduced midcranial ridge, (ii) the small spines present on the prosternum and on the front coxae, (iii) the reduced median ridge of the basisternum, (iv) the reduced metathorax which lacks halteres, suspensorial sclerites and a complete pleural ridge, and (v) the extensive pleural sclerotization which, as discussed earlier, is probably of secondary development and therefore a specialized feature. The primitive features include : (i) eight simple eyes, which is probably a primitive condition as it more closely resembles the compound eye of the margaroid ancestors, (ii) sternal plates on all the abdominal segments, (iii) a scutellum which is not tubular, (iv) a basalare connecting the pleural wing process with the episternum, and (v) the absence of prominent caudal extensions on abdominal segment VII, or caudal extensions with a cicatrix on the VIIIth.

3. The *ERIOPELTIS* group : This group consists of the two closely related genera *Eriopeltis* and *Luzulaspis*, which share about 90 characters between them. Three characters are exclusive to this group : (i) the head comparatively flat dorsoventrally, (ii) the postocular ridge not forking below ocellus, and finally, (iii) the long and narrow wings which are more than $2\frac{3}{4}$ times longer than wide. Another characteristic of this group is the presence of an interocular ridge, but this is sometimes shared by Genus *A* of the *EULECANIUM* group.

The *ERIOPELTIS* group exhibits both primitive and specialized features. The two genera share the following specialized characters : (i) an interocular ridge, connecting the pre- and postocular ridges, (ii) a more or less reduced midcranial ridge, (iii) four simple eyes, (iv) the absence of the preoral ridge, (v) a tubular scutellum, (vi) a reduced metathorax with a small episternal plate, short pleural ridge and no halteres or suspensorial sclerites, and (vii) the presence of pleural sclerotization on abdominal segment VII. In each of the two genera an additional specialized feature is found : in *Luzulaspis* the cluster of pores (and the pouch) on abdominal segment VIII has secondarily been lost (the pores are present in the more primitive margaroid Coccoidea (Morrison, 1928 ; Theron, 1958, 1962), the Pseudococcidae (Giliomee, 1961) and all the other species studied here) ; in *Eriopeltis* the median ridge of the basisternum is reduced.

The prevailing primitive features in this group are : (i) the presence of distinct anterior tentorial pits, (ii) the presence of a basalare connecting the episternum and the pleural wing process, (iii) the absence of prominent caudal extensions on abdominal segment VII or caudal extensions with a cicatrix on the VIIIth. In addition, in *Eriopeltis* the ventromedial part of the epicranium is well sclerotized, and tergites and sternites are present on all the abdominal segments.

The *ERIOPELTIS* group can be regarded as being more specialized than the next group, the *EULECANIUM* group. This conclusion is at variance with the views of Borchsenius (1957), who held that they were the most primitive Coccidae.

4. The *EULECANIUM* group : In this group the rest of the genera studied have been included, i.e. *Eulecanium, Nemolecanium, Physokermes, Rhodococcus, Parthenolecanium, Phyllostroma, Filippia, Ctenochiton, Ericerus,* Genus *A* and *Sphaerolecanium.* There is little doubt that this group is a temporary assemblage of genera, related to each other to a greater degree than to the three groups already discussed. The relationships between these genera are very complex and until more representative material has been studied in detail it seems best to treat them together, although further subdivision appears to be inevitable. The heterogeneity of this group of genera is reflected in the comparatively small number of characters (about 25) that are common to all of them. Four of these are exclusive to this group, namely (i) pleural sclerotization on the abdomen absent, (ii) fleshy ventral head setae absent, (iii) posterior metasternal setae less than 4, and (iv) fleshy setae absent posteriorly beyond abdominal segment III.

All the genera included in the *EULECANIUM* group appear to be more primitive than those of the other groups, especially the genera *Eulecanium, Nemolecanium, Physokermes, Rhodococcus, Palaeolecanium, Ericerus* and Genus *A*. They have in common the following characters, which can be regarded as being primitive : (i) a scutellum which is not tubular, (ii) a basalare connecting the pleural wing process with the episternum, (iii) a comparatively less specialized metathorax with the episternum and metapleural ridge well developed, the latter with a vestigial pleural wing process which supports the haltere, which is in turn connected to a small suspensorial sclerite, (iv) the absence of prominent caudal extensions on abdominal segment VII, (v) the absence of prominent caudal extensions with a cicatrix on abdominal segment VIII. Furthermore, three of these genera namely *Eulecanium, Nemolecanium* and *Physokermes* share a sixth primitive character in possessing small tergites and sternites on all abdominal segments (this is also shared by *Phyllostroma*). The other four genera share some of the above-mentioned characters, though not all of them. All the genera except *Physokermes, Palaeolecanium* and *Sphaerolecanium* share an additional feature which is probably primitive, i.e. having more than 4 simple eyes.

Of the genera in this group, *Sphaerolecanium* appears to be the most specialized. In this genus the scutellum is tubular (though the ventral foramen is large), the halteres are absent and the metathorax reduced, the caudal extension of the VIIIth abdominal segment forms a prominent cylindrical lobe, and only 4 eyes are present. This genus might be regarded as linking the *EULECANIUM* group with the *ERIOPELTIS* or *COCCUS* groups.

If relationships are estimated by calculating the total number of characters shared by pairs of genera it appears that the genera *Eulecanium, Nemolecanium, Physokermes, Rhodococcus* and *Palaeolecanium* are very closely related, with pairs of genera sharing between 75 and 85 characters. *Phyllostroma* also comes close to this group, especially to *Palaeolecanium.* The two genera *Filippia* and *Ctenochiton,*

while not very close to these, share between themselves a large number of characters (almost 90). The three remaining genera, i.e. *Ericerus*, Genus *A* and *Sphaerolecanium* are not very close to each other or to any of the other above-mentioned subgroups (although *Ericerus* comes close to *Rhodococcus*). It is therefore clear that the *EULECANIUM* group, in which 11 out of 19 genera studied have been included, is very heterogeneous and as more material becomes available it will undoubtedly be further subdivided.

B. From Tables 2 and 2A it can be seen that the *ERIOPELTIS* and *EULECANIUM* groups agree in a large number of characters (14), of which 6 are common to them alone (i.e. exclusive). Conversely in the *COCCUS* and *INGLISIA* groups the alternative condition of these 6 characters obtains and they share 15 characters amongst themselves. Any other way of coupling pairs of groups results in a comparatively small number of characters being shared or exclusive. It would appear therefore that there are two major groups, *ERIOPELTIS* and *EULECANIUM* on the one hand and *INGLISIA* and *COCCUS* on the other, which can be separated mainly by the absence or presence of setae in various regions of the body, as follows :

INGLISIA and *COCCUS* groups	*ERIOPELTIS* and *EULECANIUM* groups
1. Fleshy dorsal head setae present.	Fleshy dorsal head setae absent.
2. Setae between and behind ventral eyes present.	Setae between and behind ventral eyes absent.
3. Genal setae present.	Genal setae absent.
4. Fleshy postmesospiracular setae present.	Fleshy postmesospiracular setae absent.
5. Antemetaspiracular setae present.	Antemetaspiracular setae absent.
6. Fleshy dorsospiracular setae present.	Fleshy dorsospiracular setae absent.

The fact that these two groups can only be separated by differences in the chaetotaxy indicates that this family consists of a morphologically rather homogeneous group of species. This is particularly true in comparison with the Diaspididae where Ghauri (1962) found sharp and very distinct morphological differences between major groups.

At present no rank is suggested for these groups of genera indicated by male characters, but they may be considered to be equivalent to each other and representing subfamilies, while the further subdivisions in the *EULECANIUM* group, and possibly the *COCCUS* group could represent tribes.

The diagnostic characters of each group can be found in the detailed key which follows later.

C. The classification proposed above unfortunately differs considerably from the existing classification suggested by Borchsenius (1957) and a few examples are discussed as an illustration of these differences.

It will be remembered that Borchsenius based his classification on a few characters of the adult female, with considerable emphasis on the way in which the body and the eggs are protected. In his subfamily Filippiinae, Borchsenius included the three genera *Luzulaspis*, *Eriopeltis* and *Filippia*. From the male characters it is clear that whereas *Luzulaspis* and *Eriopeltis* are very closely related (sharing about 90 characters) they differ from *Filippia* in a number of striking features (and share only about 55 characters), e.g. the shape of the head, the number of eyes, the presence or absence of the interocular and preoral ridges, the shape of the wing, and in the presence or absence of fleshy ventral head setae and fleshy abdominal setae. On the other hand, *Filippia* shares up to 80 characters with some of the other genera of the *EULECANIUM* group, e.g. *Ctenochiton* and *Palaeolecanium*. It is therefore clear that *Filippia* and *Eriopeltis* are not closely related, a conclusion which supports the views of Bodenheimer (1953), who put them into different subfamilies.

In his tribe Pulvinariini Borchsenius included, among others, the two genera *Pulvinaria* and *Phyllostroma*. The males of these two genera, however, are widely different and have only a comparatively small number of characters (about 50) in common. Some of the more striking differences are found in the number of eyes, the condition of the scutellum and basalare, the development of the metathorax, the condition of the caudal extensions of abdominal segments VII–VIII, and in the chaetotaxy of the head and abdomen. *Phyllostroma* shares about 80 characters with some members of the *EULECANIUM* group (e.g. *P. bituberculatum*) and *Pulvinaria* about 90 characters with the genera of the *COCCUS* group.

On the other hand males of some genera which were widely separated by Borchsenius indicate close relationships. Thus Borchsenius considered the genera *Pulvinaria* and *Coccus* to represent two tribes of one subfamily and *Ceroplastes* a different subfamily altogether. As discussed earlier the males of these three genera are very similar and belong to the same group. The close relationship between *Pulvinaria* and *Coccus* has also been indicated by Steinweden (1959) and Bodenheimer (1953), who grouped them together into the same taxon. Both workers considered *Ceroplastes* to be distinctly different from *Coccus* and *Pulvinaria*.

Further detailed studies are needed on both males and females to show if these differences in classification of the two sexes illustrate the dependance of the grouping on the stage (or selection of characters) as found by Morrison (1928) in his studies of various stages of the Margarodidae, or reflect the inadequate knowledge of the females of the family, and finally which, if any, of the two classifications reflects the true relationships.

Genera.

In Table 3 the characters are tabulated which were found to be useful in separating genera in at least one of the three groups for which more than one genus were available. These characters are marked " G " in the columns where they operate ; where they only operate at the specific level in any of the remaining groups they are marked " S ", while the symbols " GS " are used where the characters can ap-

parently be used to separate both genera and species within the same group ; a dash (—) signifies that the character does not operate in that particular group. The table contains about 90 characters. This very high number is due to the fact that in most cases only one species per genus was available and many characters may eventually be shown to be of specific value only.

TABLE 3

LIST OF CHARACTERS WHICH MAINLY SEPARATE GENERA

Characters	Eulecanium	Eriopeltis	Coccus
HEAD:			
1. Shape of the head.	G	–	G
2. Absence or presence of polygonal reticulation on median crest.	G	–	–
3. Presence of interocular ridge.	G	–	–
4. Nature of postocular ridge, dorsally.	G	G	–
5. Nature of postocular ridge, posteromedially.	G	–	S
6. Midcranial ridge dorsally represented or not.	G	–	GS
7. Nature of sclerotization and reticulation around ventral part of midcranial ridge.	G	G	–
8. Nature of preocular ridge.	G	–	–
9. Number of simple eyes.	G	–	–
10. Distance between dorsal eyes in relation to diameter of cornea.	G	G	G
11. Distance between ventral eyes in relation to diameter of cornea.	G	–	G
12. Presence of preoral ridge.	G	–	–
13. Presence of ventral sclerite near mouth opening.	G	–	–
14. Length of cranial apophysis.	G	G	G
15. Nature of apex of cranial apophysis.	G	GS	–
16. Presence of polygonal reticulation on genae.	G	–	S
17. Presence of a pair of long, median, hair-like, ventral head setae.	G	G	–
18. Location of ventral head setae.	G	–	–

TABLE 3. LIST OF CHARACTERS WHICH MAINLY SEPARATE GENERA

Characters	Eulecanium	Eriopeltis	Coccus
ANTENNA:			
19. Length in relation to body length.	G	–	G
20. Length in relation to length of posterior leg.	G	–	–
21. Length in relation to length of penial sheath.	G	–	G
22. Length of 3rd segment in relation to its width.	G	–	G
23. Relative widths of 1st and 2nd segments.	G	–	–
24. Length of fleshy setae on 3rd segment.	G	–	–
25. Presence of hair-like setae on 3rd segment.	G	–	–
26. Number of capitate subapical setae on 10th segment.	G	–	–
27. 10th segment distally constricted or not.	–	–	G
28. Length of two smallest antennal bristles in relation to length of fleshy setae.	G	–	GS
THORAX:			
29. Number of circular pores behind pronotal sclerite.	G	–	G
30. Prosternum reticulated or not.	–	–	G
31. Number of medial pronotal setae.	G	–	GS
32. Presence of post-tergital setae.	–	–	G
33. Presence of fleshy prosternal setae.	G	–	–
34. Nature of emargination of mesoprephragma.	G	S	G
35. Nature of reticulation on prescutum.	G	G	GS
36. Length of membranous area of scutum in relation to its width.	G	–	–
37. Scutellum tubular or not.	G	–	–
38. Width of scutellum in relation to its length.	G	–	–
39. Length of basisternum in relation to length of membranous area of scutum.	G	–	–

TABLE 3. LIST OF CHARACTERS WHICH MAINLY SEPARATE GENERA

Characters	Eulecanium	Eriopeltis	Coccus
THORAX—*contd.*			
40. Presence of fleshy scutal setae.	–	–	G
41. Number of hair-like scutal setae.	G	–	–
42. Presence of postalary setae.	–	–	G
43. Number of fleshy postmesospiracular setae.	–	–	G
44. Presence and type of basisternal setae.	G	–	G
45. Presence of suspensorial sclerite.	G	–	–
46. Nature of metapleural ridge.	G	–	–
47. Number of fleshy anterior metasternal setae.	G		–
48. Length of wing in relation to its width.	G	–	–
49. Presence of alar setae.	G	–	–
50. Presence of halteres.	G	–	–
51. Number of haltere setae.	G	–	–
52. Length of hind leg in relation to body length.	G	–	S
53. Presence on coxal bristles on front coxa.	G	–	S
54. Total number of setae on front tibia.	G	–	–
55. Length of apical seta on front trochanter in relation to width of trochanter.	G	G	G
56. Shape of hind femur (length/width).	G	–	G
57. Relative number of fleshy and hair-like setae on hind tibia.	G		–
58. Relative length of fleshy setae on tibiae.	G		–
59. Relative numbers of fleshy and hair-like setae on hind tarsus.	G		G
60. Length of hind tarsus in relation to its width.	G		GS
61. Relative length of hind claw.	G	G	–

TABLE 3. LIST OF CHARACTERS WHICH MAINLY SEPARATE GENERA

Characters	Eulecanium	Eriopeltis	Coccus
ABDOMEN:			
62. Number of tergites.	G	G	–
63. Nature of tergite between segm. I and II.	G	–	G
64. Number of sternites.	G	–	G
65. Absence or presence of glandular pouch on segm. VIII.	–	G	–
66. Shape of caudal extension of segm. VIII.	G	–	G
67. Location of cicatrix on segm. VIII.	–	–	G
68. Length of external in relation to "internal" part of setae of glandular pouch.	G	G	G
69. Number of fleshy dorsal setae.	–	–	G
70. Number of hair-like dorsal setae on segm. I.	G	–	G
71. Number of hair-like dorsal setae on segm. III.	G	–	G
72. Presence of fleshy ante-anal setae.	G	G	G
73. Presence of 2 long hair-like ante-anal setae.	G	–	G
74. Number of fleshy setae around glandular pouch.	–	–	G
75. Presence of circular pores in ante-anal region.	G	G	G
76. Presence of fleshy pleural setae.	G	–	–
77. Presence of fleshy ventral setae.	G	–	–
78. Number and arrangement of hair-like setae ventrally on segm. II.	G	–	GS
79. Number of hair-like ventral setae on segs. VI and VII.	G	–	G
80. Lateral sclerotization of penial sheath fused anterior to anus or not.	G	–	G
81. Presence and size of membranous extension of penial sheath.	–	–	G
82. Length of penial sheath in relation to body length.	G	G	G

TABLE 3. LIST OF CHARACTERS WHICH MAINLY SEPARATE GENERA

Characters	Eulecanium	Eriopeltis	Coccus
ABDOMAN—*contd.*:			
83. Length of basal rod in relation to length of aedeagus.	G	G	GS
84. Basal rod reaching basal membranous area or not.	G	–	–
85. Length of aedeagus in relation to length of penial sheath.	G	–	–
86. Length of aedeagus in relation to length of basisternum.	G	–	S

COCCUS group : All the genera of this group are very closely related but each has a characteristically shaped caudal extension on abdominal segment VIII. *Ceroplastes* also differs from the others in the shape of the head.

INGLISIA group : Only one genus was studied and generic differences can therefore not be discussed.

ERIOPELTIS group : The two genera *Eriopeltis* and *Luzulaspis* are very closely related but *Luzulaspis* is distinct in lacking the glandular pouch and pores.

EULECANIUM group. The genera *Eulecanium, Nemolecanium, Physokermes* and *Rhodococcus* are very closely related, but can easily be separated by the number of eyes. *Palaeolecanium* differs from these genera in possessing a comparatively short penial sheath. *Phyllostroma* is also rather closely related to these genera but is characterized in lacking halteres and in having the metapleuron reduced. The two genera *Ctenochiton* and *Filippia* form a distinct subgroup that can be separated from the aforementioned in having a tubular scutellum and from each other by the number of eyes and the development of the basal rod of the aedeagus. The three remaining genera of the group are all very distinct. *Ericerus* is characterized by the long, narrow head and the extremely long fleshy setae on the appendages, Genus *A* by the exceptionally short and thick fleshy setae on the appendages and the possession of a ventral sclerite, whereas *Sphaerolecanium* is the only genus in this group with a prominent caudal extension on abdominal segment VIII, a basal rod longer than the aedeagus and fleshy prosternal, anterior metasternal and abdominal setae.

Species.

In Table 4 the characters are listed which separate species in the four genera in which more than one species were available ; a " × " sign indicates the genus in which the character operates. From the table it can be seen that differences between species are not only indicated by differences in the chaetotaxy and

reticulation in various regions of the body, but also by differences in the development of certain ridges such as the midcranial ridge, the postoccipital ridge and the median ridge of the mesobasisternum.

TABLE 4

LIST OF CHARACTERS WHICH SEPARATE SPECIES

Characters	Eriopeltis	Pulvinaria	Partheno-lecanium	Ceroplastes
1. Degree of sclerotization of postero-median part of postocular ridge.	–	–	×	–
2. Presence of lateral arms of mid-cranial ridge.	×	–	–	–
3. Shape of apex of cranial apophysis.	×	–	–	–
4. Presence of reticulation on gena.	–	×	–	–
5. Presence of reticulation on pedicel.	–	×	–	–
6. No. of fleshy setae between and behind ventral eyes.	–	–	–	×
7. No. of fleshy setae on 4th antennal segment.	–	–	–	×
8. Size of two shortest antennal bristles.	–	×	–	–
9. Presence of reticulation on the post-tergital region.	×	–	–	–
10. Nature of emargination of mesoprephragma.	×	–	–	–
11. Presence of reticulation on mesoprescutum.	–	×	–	–
12. Presence of reticulation on anterior arms of mesoscutum.	×	–	–	–
13. Presence of reticulation on membranous area of scutum.	×	–	–	–
14. Size of ventral foramen of scutellum.	–	–	×	–
15. Development of median ridge of mesosternum.	×	–	–	–
16. Length of hind leg in relation to body length.	–	×	–	–

Table 4. List of Characters which Separate Species

Characters	Eriopeltis	Pulvinaria	Parthenolecanium	Ceroplastes
17. Length of hind tarsus in relation to its width.	–	×	–	–
18. Presence of median pronotal setae.	–	–	×	–
19. Presence of coxal bristles.	–	–	–	×
20. No. of fleshy pleural setae on 7th abdominal segment.	–	–	–	×
21. No. of fleshy ventral setae on 7th abdominal segment.	–	–	–	×
22. Size of aedeagus (e.g. in relation to basal rod or aedeagus).	–	–	–	–

Relationships of the Coccidae with other Subdivisions of the Coccoidae

The division of the Coccoidea into the margaroid, lecanoid and diaspidoid types by Balachowsky (1937, 1942) has been generally supported by the results of more detailed investigations of the adult males (Theron, 1958), as well as by cytological studies (Hughes-Schrader, 1942 ; Brown, 1959). Of the families of which the males have been studied intensively, the margaroid type includes the Margarodidae and Phenacoleachiidae (Theron, 1958, 1962), the lecanoid type the Pseudococcidae and Coccidae, and the diaspidoid type the Diaspididae. Theron (1958) showed that the Pseudococcidae and Coccidae were very closely related and that their closest relatives were found in the margarodid *Steingelia* on the one hand and the Diaspididae on the other. He regarded the diaspidoids as being more closely related to the lecanoids than the latter are to the margaroids and this view was supported by Ghauri (1962).

Theron's conclusions regarding the affinities of the Coccidae were based mainly on the one species that he studied in detail, *Parthenolecanium pomeranicum*. The results of the present investigation, in which a fairly representative sample of the Coccidae was studied, generally confirm and supplement Theron's observations. A few structures of morphological importance, which were either overlooked or absent in the species studied by Theron, can be recorded here :

1. *Vestigial dorsal part of the midcranial ridge.* This short median ridge is present in some members of the *EULECANIUM* and *COCCUS* groups, though not in the species studied by Theron. It is more fully developed in the Pseudococcidae (Theron, 1958 ; Giliomee, 1961), but absent in the Diaspididae (Ghauri, 1962). The greater reduction or absence of the dorsal section of the midcranial ridge (considered to be primary) is a specialization in the Coccidae.

2. *Interocular ridge.* This ridge, which connects the pre- and postocular ridges below the ocellus, is present and always well developed in the *ERIOPELTIS* group.

It also occurs, although in a more or less reduced condition, in most specimens of Genus *A*. One is tempted to suggest that this condition was the forerunner of the situation in the Pseudococcidae where the pre- and postocular ridges are fused, but the fact that both the *ERIOPELTIS* group and Genus *A* are comparatively specialized, though with little affinity between them, makes this seem unlikely. Presumably the ridge evolved independently to support the preocular ridge near the point where it articulates with the antenna, which is exceptionally long in *Eriopeltis* and fairly long in Genus *A*.

3. *Anterior tentorial pits.* These structures can be seen in the *ERIOPELTIS* group and in some members of the *EULECANIUM* group (e.g. *Ericerus* and *Phyllostroma*). They are absent in the Pseudococcidae,where the anterior tentorial arms are fused with each other and with the cranial apophysis. In the Diaspididae the tentorium is absent altogether, but vestigial anterior and posterior tentorial pits remain in some species (Ghauri, 1962).

4. *Lateral pronotal sclerite.* A small lateral pronotal sclerite is present in all Coccidae. Homologous structures are found in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

5. *Post-tergite.* The absence of this sclerite in the Coccidae is listed as a specialized character by Theron (1958). It was observed, however, in all the species studied here, including *P. pomeranicum*. It is present in all the other Coccoidea, except *Steingelia* (Theron 1958).

6. *Metapleural apophyses.* Vestigial metapleural apophyses, of the same nature as found in *Pseudococcus* (Giliomee, 1961), are present.

7. *Basalare.* This structure is vestigial or absent in *P. pomeranicum* (and the other members of the *COCCUS* group) and this was accordingly regarded by Theron as a specialized feature of the Coccidae. It was found, however, in all the members of the *EULECANIUM*, *ERIOPELTIS* and *INGLISIA* groups, where the condition is very similar to that in the Pseudococcidae (Theron, 1958) and the Diaspididae (Ghauri, 1962).

8. *Metasternal sclerite.* A distinct metasternal plate was found in most of the species studied, including *P. pomeranicum*. This is a primitive character, present in all the Coccoidea except the Pseudococcidae. The Pseudococcidae, on the other hand, have metasternal apophyses (Giliomee, 1961), which are absent in the Coccidae.

9. *Sclerotization of the abdomen.* In *P. pomeranicum* and the Pseudococcidae studied by Theron and Giliomee, the abdomen is considerably desclerotized and this is regarded as a specialized condition which the lecanoids share with the diaspidoids (Ghauri, 1962). However, it was found that in some of the genera of the Coccidae, like *Luzulaspis*, *Nemolecanium*, *Eulecanium*, *Physokermes* and *Phyllostroma* both tergal and sternal plates (although reduced) were present. This is undoubtedly primitive.

This study has shown therefore that, as far as the relationship with the margaroid type is concerned, only minor alterations are necessary in the list of characters given by Theron (1958) that separate the lecanoid type from the basic margaroid

type. That is in so far as metasternal and abdominal sclerites are not absent in the Coccidae.

The relationships with the basic margaroid male and the diaspidoid male, as expressed by the characters shared with the lecanoid male, is shown in Table 5.

Table 5

Showing Relationships of Lecanoid Male with the Margaroid and Diaspidoid Types

	Margaroid	Lecanoid	Diaspidoid
A. Primitive characters:			
1. Head well sclerotized.	×	×	–
2. Tentorium present.	×–	×	–
3. Distinct propleural apophyses present.	×	×	–
B. Specialized characters:			
1. Compound eyes absent.	–	×	×
2. Lateral branches of midcranial ridge present.	–	×	×
3. Cranial apophysis long.	–	×	×
4. Pronotal ridges present.	–	×	×
5. Post-tergites small.	–	×	×
6. Prescutal ridges shifted medially.	–	×	×
7. Prealare differentiated into a triangular sclerite.	–	×	×
8. Subepisternal ridge detached from marginal ridge.	–	×	×
9. Abdominal spiracles absent.	–	×	×

From Table 5 it can be seen that the lecanoids and diaspidoids have a large number (9) of specialized characters in common, whereas 3 primitive ones are shared by the lecanoids and margaroids. It can therefore be stated that the lecanoids are more closely related to the diaspidoids than to the margaroids and also that they are more specialized than the margaroids but less than the diaspidoids This conclusion confirms the views of Theron (1958) and Ghauri (1962).

Two genera of which the males were studied by Theron (1958, 1962), i.e. *Steingelia* and *Phenacoleachia*, were regarded by him as occupying an intermediate position between the more primitive margaroids (*Margarodes* and *Pseudaspidoproctus*) on the one hand and the lecanoids (Coccidae and Pseudococcidae) on the other. He showed that *Steingelia* and *Phenacoleachia* were closely related, but that they differ in a number of striking features. When one investigates whether these differences throw any light on the relationships of the two genera with the two lecanoid families, rather interesting results are found, as shown in Table 6. In this table the characters known to differentiate male *Steingelia* and *Phenacoleachia* are listed and compared with conditions in the Coccidae and Pseudocociddae.

Table 6

Characters differentiating male *Steingelia* and *Phenacoleachia* compared with conditions in Coccidae and Pseudococcidae

	Cocc-idae	Stein-gelia	Phenaco-leachia	Pseudo-coccidae
1. Postoccipital ridge completely absent.	×	×	–	–
2. Postocular ridge present.	×	–	×	×
3. Cranial apophysis extended.	×	×	–	–
4. Membranous area of scutum present.	×	×	–	–
5. Scutellum short, transverse.	×	×	–	–
6. Median ridge of basisternum present.	×	×	–	–
7. Disc pores on body (other than glandular pouch) absent.	×	×	–	–

From the table it can be seen that, in 6 out of 7 cases, similar conditions obtain in *Steingelia* and the Coccidae whereas, of the opposite conditions, all 7 characters are shared between *Phenacoleachia* and the *Pseudococcidae*. These results indicate that the Coccidae are more similar to *Steingelia* than to *Phenacoleachia*, and the *Pseudococcidae* more to *Phenacoleachia* than to *Steingelia*. At this stage of research it is difficult to determine, however, whether the similarities have any phylogenetic significance or whether they are merely due to convergence.

In a number of characters, male Coccidae differ from male Pseudococcidae, the only other lecanoid family of which the male has so far been studied in detail (Theron, 1958 ; Giliomee, 1961). These characters are listed in Table 7 and compared with conditions obtaining in the basic margaroid (i.e. excluding *Steingelia* and *Phenacoleachia*) and diaspidoid types.

Table 7

Characters differentiating male Coccidae and Pseudococcidae compared with conditions in Margaroid and Diaspidoid types

	Margaroid	Pseudococcidae	Coccidae	Diaspidoid
A. Primitive characters:				
1. Anterior tentorial pits/arms separate.	×	–	×	×
2. Membranous area of scutum present.	×	–	×	–
3. Median ridge of basisternum present.	×	–	×	×
4. Metasternal sclerite present.	×	–	×	×
5. Ostiole absent.	×	–	×	×
B. Specialized characters:				
1. Postoccipital ridge absent.	–	–	×	–
2. Scutellum short, transverse.	–	–	×	×
3. Metasternal apophyses absent.	–	–	×	×
4. Penial sheath elongated.	–	–	×	×
5. Disc pores on body (other than glandular pouch) absent.	–	–	×	×

A few remarks should be made concerning the interpretation of the phylogenetic significance of the membranous area of the scutum (character A2) as indicated in Table 7. In the primitive margaroid type it is absent in *Margarodes* (Theron, 1958) and also in *Phenacoleachia* (Theron, 1962) but developed to some extent in *Pseudaspidoproctus*, *Steingelia* (Theron, 1958) and *Icerya* (Balachowsky, 1937); in the specialized diaspidoid type it is absent (Theron, 1958 ; Ghauri, 1962). Similar considerations make the interpretation of the median ridge of the basisternum (character A3) difficult. The occurrence of both these structures over a wide range within the superfamily, including decidedly more primitive forms, does suggest that, as far as the Coccidae and Pseudococcidae are concerned, their presence signifies a primitive condition. For the opposite to be true it would mean that these structures were absent in their common ancestor and have been evolved independently in the Coccidae, which seems unlikely. As mentioned earlier, two

of the specializations that Theron (1958) recorded, i.e. the absence of a post-tergite and basalare are not valid as they were found to be present in this family.

From Table 7 it can be seen that the two families share an equal number of primitive and specialized features and on the basis of these facts alone it is difficult to decide which of the two families is more specialized. It is clear from the table that the Coccidae show an overall affinity with the more specialized Diaspididae, sharing 8 out of 10 characters with that family, whereas the Pseudococcidae have only 2 out of 10 characters with the Diaspididae in common. It can therefore be said that the Coccidae are possibly more specialized than the Pseudococcidae. It will also be remembered that the membranous area of the scutum and the median ridge of the basisternum have somewhat speculatively been interpreted as being primitive features. Should the opposite be true, it would prove decisively (by 7 specialized characters to 3 primitive) that the Coccidae were more specialized than the Pseudococcidae. The conclusion that the Pseudococcidae are more primitive than the Coccidae supports the opinions based on the evidence of female characters (Morrison, 1928 ; Balachowsky, 1942 ; Borchsenius, 1958), cytological studies (Hughes-Schrader, 1948) and earlier, less comprehensive studies of the male (Theron, 1958 ; Giliomee, 1961).

From the existing literature on the males of other families of the lecanoid type, scanty as it is, a few tentative conclusions can be reached regarding their relationships to the Coccidae. Thus the illustrations and descriptions by Green (1904–1909), Russel (1941) and Borchsenius (1960) indicate that the males of the Asterolecaniidae have a large membranous area in the scutum, a transverse scutellum and an elongated penial sheath. In these respects they resemble the Coccidae and at the same time differ from the Pseudococcidae. It can therefore be suggested that the Asterolecaniidae and Coccidae are closely related, as has been advocated by Balachowsky (1948) and Ferris (1955) from studies of the females.

From the description of the male of *Kermococcus quercus* (L.) by Borchsenius (1960), it appears that the Kermococcidae are more closely related to the Coccidae than to any of the other Coccoidea of which the males have been studied in detail. Thus *K. quercus* possesses 5 pairs of simple eyes ; separate pre- and postocular ridges ; a large membranous area in the scutum ; a comparatively short, transverse and possibly tubular scutellum ; a deeply invaginated glandular pouch ; an elongated penial sheath, long aedeagus and a ridge-like basal rod. In all these respects it differs from the Pseudococcidae. The only character which at present appears to be exclusive to the Kermococcidae and Pseudococcidae is the two-segmented tarsus. The males of the Kermococcidae therefore appear to show different relationships from those assigned to these forms by various workers on female Coccoidea. Balachowsky (1942, 1948) grouped them together with the pseudococcids and eriococcids into one family ; Ferris (1957b) regarded them as a subfamily of the Eriococcidae and grouped them with the Pseudococcidae, amongst others, into the ramus Eriococci, whereas the Coccidae and Asterolecaniidae were assigned to the ramus Cocci. Obviously, more detailed studies are necessary before any firm conclusions can be reached regarding the true relationships of these groups.

KEYS

As is the case with the preceding descriptions of the species studied, the following keys contain many more characters than would eventually be necessary for the purposes of identification. However, it is considered wise to follow Ghauri (1962) and compile detailed keys because (i) they constitute provisional definitions of the spuraspecific categories and (ii) because there is little doubt that some of the characters will eventually prove to be insignificant at the taxonomic levels at which they are employed here. It is clear from the following keys that both higher and lower taxa can easily be separated.

Key to the Groups of Genera

1 With fleshy dorsal head setae, setae between and behind the ventral simple eyes, genal setae, fleshy postmesospiracular setae, antemetaspiracular setae and fleshy dorsospiracular setae all present 2

– With fleshy dorsal head setae, setae between and behind the ventral simple eyes, genal setae, fleshy postmesospiracular setae, antemetaspiracular setae and fleshy dorsospiracular setae all absent 3

2 Antenna shorter than posterior leg ; midcranial ridge ventrally complete ; with 4 simple eyes ; prosternum not spinose ; scutellum tubular, usually more than 3 times (range 2·8–4·1) as wide as long ; basalare not joining pleural wing process to mesepisternum ; median ridge of basisternum complete ; anterior metasternal setae more than 36 ; wings usually less than $2\frac{1}{4}$ times (range 1·9–2·3) longer than wide ; with pleural sclerotization only on 7th abdominal segment ; caudal extension of abdominal segment VII very prominent, tapering ; with a cicatrix on caudal extension of abdominal segment VIII ; fleshy pleural setae on abdominal segments I–III present ; fleshy setae on sternite VIII not more than 3, if present . . . . . *COCCUS* group

– Antenna 1·07–1·15 (average 1·10) times longer than posterior leg ; midcranial ridge ventrally reduced ; with 8 simple eyes ; prosternum spinose ; scutellum not tubular, 2·11–2·86 (average 2·36) times as wide as long ; basalare joining pleural wing process to mesepisternum ; median ridge of basisternum reduced or absent ; anterior metasternal setae 13–24 (average 18) ; wings 2·33–2·45 (average 2·38) times longer than wide ; with a band of pleural sclerotization stretching from the IVth–VIIth abdominal segments ; caudal extension of abdominal segment VII small, broadly rounded ; without a cicatrix on caudal extension of abdominal segment VIII ; fleshy pleural setae on abdominal segments I–III absent ; fleshy setae on sternite VIII more than 5 . . . . . *INGLISIA* group

3 Head (in lateral view) flat ; fleshy ventral head setae present ; broad interocular ridge present ; postocular ridge not forking below ocellus ; posterior metasternal setae present, minimum 7 ; wings more than $2\frac{3}{4}$ times longer than wide ; abdominal segment VII with pleural sclerotization ; with fleshy ventral setae occurring posteriorly beyond abdominal segment IV . . *ERIOPELTIS* group

– Head (in lateral view) dorsoventrally elongated or rounded ; fleshy ventral head setae absent ; interocular ridge absent or (in Genus *A*) very narrow ; postocular ridge forking below ocellus ; posterior metasternal setae usually absent, maximum 3 ; wings less than $2\frac{3}{4}$ times longer than wide ; abdomen without pleural sclerotization ; fleshy ventral setae not occurring posteriorly beyond abdominal segment IV . . . . . *EULECANIUM* group

Keys to Genera and Species

Key to the *EULECANIUM* Group of Genera

1 Head with anterodorsal bulge somewhat pronounced ; fleshy prosternal setae present ; fleshy anterior metasternal setae 11–18 (average 14) ; abdominal segment VIII with a large, cylindrical caudal extension ; fleshy pleural setae present on posterior abdominal segments and fleshy ventral setae present on abdominal segments II and sometimes III ; abdominal segments VI and VII usually with 4 and 2 setae respectively ; basal rod $1\frac{3}{4}$–2 times as long as aedeagus.
SPHAEROLECANIUM (S. prunastri (Fonsc.))

– Head with anterodorsal bulge not pronounced ; fleshy prosternal setae absent ; fleshy anterior metasternal setae absent ; abdominal segment VIII with a small convex caudal extension ; fleshy abdominal setae absent ; abdominal segments VI and VII with either 4 or 2 setae on both segments ; basal rod shorter or as long as aedeagus 2

2 Head (in lateral view) rounded ; ventral sclerite near mouth opening present ; fleshy setae very short and thick, being less than 0·60 times as long as width of 3rd antennal segment and shorter than width of hind tibia ; 10th antennal segment with 4–6 (average 5) capitate subapical setae . . . . . Genus ***A***

– Head (in lateral view) dorsoventrally elongated ; ventral sclerite absent ; fleshy setae medium-sized or long, being 0·67–5·00 times as long as width of 3rd antennal segment, and as long, to 5 times as long as width of tibia ; 10th antennal segment with 2 or 3 capitate subapical setae 3

3 Third antennal segment more than 4 times (range 4·6–6·3, average 5·3) longer than wide ; fleshy setae very long, 4–5 times as long as width of 3rd antennal segment and tibia ; sternites on abdominal segment II absent ; abdominal segment II with one hair-like seta on each side . . . ***ERICERUS*** (***E. pela*** (Chav.))

– Third antennal segment less than 4 times (range 1·8–3·6) longer than wide ; fleshy setae medium-sized, less than twice as long as width of 3rd antennal segment and tibia ; sternite(s) on abdominal segment II present ; abdominal segment II with 2 medially situated hair-like setae 4

4 Median crest not polygonally reticulated ; scutellum tubular ; with more than 6 hair-like scutal setae 5

– Median crest polygonally reticulated ; scutellum not tubular ; with less than 5 hair-like scutal setae 6

5 With 8 simple eyes ; with 1–4 (average 2.2) dorsal ocular setae ; with small circular pores behind pronotal sclerites, around metatergal setae, on abdominal segment I and in the ante-anal region ; suspensorial sclerite spot-like ; fore wings 2·36–2·56 (average 2·46) times longer than wide, with 1–2 (average 1·1) alar setae on each side ; hind tarsus 5·6–7·0 (average 6·3) times longer than wide; without a separate median tergite between abdominal segments I and II ; setae of glandular pouch with external part 3–4 times as long as the section within the pouch ; lateral sclerotizations of penial sheath narrowly joined anterior to anus ; length of basal rod $\frac{2}{3}$ to equal that of aedeagus, basal rod not reaching apex of basal membranous area ; aedeagus short, the basisternum being 1·74–1·92 (average 1·85) times longer . . . . . ***CTENOCHITON*** (***C.*** sp.)

– With 10 simple eyes ; with no dorsal ocular setae ; circular pores absent ; suspensorial sclerite elongate ; fore wings 2·04–2·25 (average 2·09) times longer than wide, with no alar setae ; hind tarsus 5·1–5·3 (average 5·2) times longer than wide ; with a separate median tergite between abdominal segments I and II ; setae of glandular pouch with external part about twice as long as the section within the pouch ; lateral sclerotizations of penial sheath not joined anterior to anus ; basal rod less than half as long as aedeagus, reaching apex of basal membranous area ; aedeagus long, the basisternum being only 1·23–1·39 (average 1·34) times longer . . . . . ***FILIPPIA*** (***F. viburni*** (Sign.))

6 Halteres and suspensorial sclerites absent, metapleural ridge reduced ; fleshy postmetaspiracular setae present ; abdominal segment III with no hair-like setae medially ; pleural sclerotizations of penial sheath narrowly joined anterior to anus . . . . . ***PHYLLOSTROMA*** (***P. myrtilli*** (Kalt.))

– Halteres and suspensorial sclerites present, metapleural ridge complete ; fleshy postmetaspiracular setae absent ; abdominal segment III usually with 2 setae medially, rarely one ; pleural sclerotizations not joined anterior to anus . . 7

7 With 1–4 (average 2·7) scutal setae ; with only one haltere seta on each side ; with 2 hair-like setae dorsally on abdominal segment I ; penial sheath medium-sized, the ratio of its length in relation to body length being 1 : 5·09–5·63 (average 5·39). ***PALAEOLECANIUM*** (***P. bituberculatum*** (Targ.))

– With no scutal setae ; with more than one haltere seta on at least one side (usually 2, range 1–4) ; usually with no hair-like setae dorsally on abdominal segment I, occasionally with one ; penial sheath very long, the ratio of its length in relation to body length being 1 : 3·15–4·15 8

8 Dorsal part of midcranial ridge absent ; with 8 simple eyes ; apex of cranial apophysis truncate ; antenna longer than half body length, the ratio of its length in relation to body length being 1 : 1·52–1·61 (average 1·57) ; antenna also 2·4–2·6 (average 2·5) times longer than penial sheath ; 3rd antennal segment without hair-like setae ; scutellum 1·5–1·7 (average 1·6) times wider than long ; legs moderately long, the ratio length of hind leg to body length being 1 : 1·72–1·83 (average 1·78) ; claws long, hind claw about 1½ times as long as width of tarsus ; abdominal tergites and sternites absent on segments IV and V ; abdominal segment II usually with none, but occasionally with one median hair-like seta ventrally . . . . . ***RHODOCOCCUS*** (***R. spiraeae*** (Borchs.))

– Vestigial dorsal part of midcranial ridge present ; with 4, 6 or 10 simple eyes ; apex of cranial apophysis bifurcate ; antenna shorter than half body length, the ratio of its length in relation to body length being 1 : 2·02–2·92 ; antenna only 1·3–2·1 times longer than penial sheath ; 3rd antennal segment with one or more hair-like setae ; scutellum 1·8–2·3 times wider than long ; legs short, the ratio length of hind leg to body length being 1 : 2·07–2·47 ; claws medium-sized, as long or a little longer than width of tarsus ; tergites and sternites present on all abdominal segments ; abdominal segment II with 2 median hair-like setae ventrally 9

9 With 4 simple eyes ; mesoprephragma without an emargination ; prescutum with distinct polygonal reticulation ; basisternum 1·7–2·4 (average 2·1) times longer than membranous area of scutum ; alar setae absent ; coxal bristles absent ; apical seta on trochanter 2·1–2·6 (average 2·4) times as long as width of trochanter; abdominal segments VI and VII usually with 2 setae on both segments; basal rod short, length ⅓–½ that of aedeagus . . ***PHYSOKERMES*** (***P. piceae*** (Schr.))

– With 6 or 10 simple eyes ; mesoprephragma with shallow emargination ; prescutum with weak or no reticulation ; basisternum 2·5–3·6 times longer than membranous area of scutum ; alar setae present on at least one side (range 0–3) ; coxal bristles present ; apical seta on trochanter 3–4 times as long as width of trochanter ; abdominal segments VI and VII usually with 4 setae on both segments ; basal ridge medium-sized, length ⅔–¾ that of aedeagus . . . 10

10 Degree of sclerotization of postocular ridge not reduced posteromedially ; with 6 simple eyes ; genae not reticulated ; antenna longer than posterior leg, ratio 1 : 1·04–1·14 (average 1·07) ; 3rd antennal segment 2·5–3·0 (average 2·8) times longer than wide ; basisternum usually with 1 or 2 hair-like setae ; setae of glandular pouch with external part about twice as long as the section within the pouch ; basal rod extending $\frac{9}{10}$ths of the length from aedeagus to apex of basal membranous area . . . . ***NEMOLECANIUM*** (***N. abietis*** Borchs.)

– Degree of sclerotization of postocular ridge reduced posteromedially ; with 10 simple eyes ; genae weakly polygonally reticulated ; antennae shorter than posterior leg, ratio 1 : 0·73–0·87 (average 0·80) ; 3rd antennal segment 1·8–2·2 (average 2) times longer than wide ; basisternum without setae ; setae of glandular pouch with external part about 1½ times as long as the section within the pouch ; basal rod extending ⅔ or ¾ of the length from aedeagus to apex of basal membranous area . . . . . ***EULECANIUM*** (***E. tiliae*** (L.))

Key to the Genera and Species of the *ERIOPELTIS* Group

1 With a pair of median, hair-like ventral head setae distinctly longer than the rest ; 3rd antennal segment 3·0–3·7 (average 3·3) times longer than wide ; prescutum distinctly polygonally reticulated ; median ridge of basisternum complete ; tergites present on all the abdominal segments ; glandular pouch absent, represented by a slight depression with one long seta ; ante-anal region with no fleshy setae, but 2–6 circular pores ; penial sheath short, the ratio of its length in relation to body length being 1 : 6·06–7·28 (average 6·66).

LUZULASPIS (***L. luzulae*** (Dufour))

– Without a pair of long, median, hair-like ventral head setae ; 3rd antennal segment 4–6 times longer than wide ; prescutum not distinctly reticulated ; median ridge of basisternum to a greater or lesser degree reduced ; tergites absent on abdominal segments III–VI ; glandular pouch present, containing 2 long setae ; ante-anal region with 1–9 fleshy setae but no pores ; penial sheath medium-sized, the ratio of its length in relation to body length being 1 : 4·46–4·92. ***ERIOPELTIS*** 2

2 Lateral arms of midcranial ridge absent ; apex of cranial apophysis truncate or rounded ; median ridge of basisternum interrupted, combined length of separate parts more than half the length of the basisternum ; post-tergital region, and anterior arms and membranous area of scutum not reticulated.

Eriopeltis ?festucae (Fonsc.)

– Lateral arms of midcranial ridge present ; apex of cranial apophysis trifurcate ; median ridge of basisternum reduced to a few vestiges of which the combined length is less than half the length of the basisternum ; post-tergital region, and anterior arms and membranous area of scutum weakly reticulated . ***Eriopeltis*** sp.

Key to the Genera and Species of the *COCCUS* Group

1 Head with anterodorsal bulge not pronounced ; with 14–32 fleshy postmesospiracular setae ; with 1–6 postalary setae ; segment VIII laterally with a large semicircular caudal extension, which carries a large cicatrix posterodorsally ; without 2 long, hair-like ante-anal setae ; with 2–7 fleshy setae lateral to glandular pouch ; abdominal segment VI ventrally with 2 or less hair-like setae, usually one on each side ; penial sheath with a large, finger-like, membranous extension at the apex . . . . . ***CEROPLASTES*** 2

– Head with anterodorsal bulge pronounced ; with more than 43 fleshy postmesospiracular setae ; usually without postalary setae ; abdominal segment VIII laterally with a geniculate, mammillate or papilla-shaped caudal extension which carries a small lateral or large posterior cicatrix ; with 2 long, hair-like ante-anal setae ; without fleshy setae lateral to glandular pouch ; abdominal segment VI ventrally with 3 or more hair-like setae, usually 2 laterally and 2 medially ; penial sheath with a very small or no membranous extension at the apex . . . 3

2 Vestigial dorsal part of midcranial ridge present on anterior margin of head ; with 11–21 (average 16) fleshy setae between and behind ventral simple eyes ; 4th antennal segment with 23–29 (average 26) fleshy setae ; with 2–4 (average 3·2) coxal bristles ; abdominal segment VII ventrally with 6–11 (average 9·2) fleshy setae ; aedeagus short, basal rod about 2 times longer and penial sheath 4·1–4·9 (average 4·5) times longer . . . . . ***Ceroplastes*** sp.

– Dorsal part of midcranial ridge absent ; with 5–9 (average 7·1) fleshy setae between and behind ventral simple eyes ; 4th antennal segment with 11–19 (average 15) fleshy setae ; coxal bristles absent ; abdominal segment VII with 1–5 (average 3) fleshy setae ; aedeagus medium-sized, about as long as basal rod, and penial sheath 3·0–3·4 (average 3·2) times longer . . . . . ***C. berliniae*** Hall

3 Post-tergital setae absent ; hind tarsus usually with more hair-like than fleshy setae; tergites between abdominal segments I and II consisting of a small sclerite on each side ; abdominal segment VIII laterally with a papilla-shaped caudal extension, which carries a small cicatrix laterally . . . ***PARTHENOLECANIUM*** 4

– Post-tergital setae present on at least one side ; hind tarsus with more fleshy than hair-like setae ; tergites between abdominal segments I and II consisting of a small sclerite on each side and a separate median sclerite ; abdominal segment VIII with a geniculate or mammillate caudal extension which carries a large posterior and small lateral cicatrix respectively 5

4 Usually with a pair of hair-like medial pronotal setae ; ventral foramen of scutellum large, length usually more than half that of scutellum ; caudal extension of abdominal segment VII with 4–8 (average 5) fleshy setae.
Parthenolecanium pomeranicum (Kaw.)

– Usually without hair-like medial pronotal setae ; ventral foramen of scutellum small, length usually less than half that of scutellum ; caudal extension of abdominal segment VII with 11–25 fleshy setae. ***Parthenolecanium corni*** (Bouché)

5 Vestigial dorsal part of midcranial ridge present ; distal part of terminal antennal segment not constricted ; mesoprephragma with a shallow emargination ; fleshy scutal setae absent ; femora of medium length, hind femur 3·86–4·75 times longer than wide ; lateral margin of abdominal segment VIII with a mammillate caudal extension which carries a very small cicatrix laterally ; a few fleshy ante-anal setae usually present (range 0–7) ; length of basal rod about equal to 1¼ times that of aedeagus . . . . . ***PULVINARIA*** 6

– Dorsal part of midcranial ridge absent ; distal part of terminal antennal segment somewhat constricted ; mesoprephragma with deep emargination ; with 7–32 fleshy scutal setae ; femora long and narrow, hind femur 5·98–6·71 times longer than wide ; lateral margin of abdominal segment VIII with a geniculate or cylindrical caudal extension which carries a large cicatrix posteriorly ; fleshy ante-anal setae absent ; length of basal rod more than 1¼ times that of aedeagus . 7

6 The two shortest antennal bristles on the terminal antennal segment about half as long as the fleshy setae ; pedicel, gena and mesoprescutum distinctly polygonally reticulated ; abdominal segment II usually with one or more (range 0–6) hair-like setae ventrally . . . . . ***Pulvinaria ?betulae*** (L.)

– The two shortest antennal bristles on the terminal antennal segment longer and thicker than the fleshy setae ; reticulation on pedicel, gena and mesoprescutum absent or very weak ; abdominal segment II ventrally without hair-like setae.
Pulvinaria acericola (Walsh & Riley)

7 With 10–22 (average 16) fleshy dorsal head setae ; 4th antennal segment 9–11 (average 10) times longer than wide ; length of 2 shortest antennal bristles about equal that of the fleshy setae ; prosternum not reticulated ; with 2–9 (average 5·4) fleshy basisternal setae ; abdominal segment VIII with a geniculate caudal extension ; setae of glandular pouch with external part about 2–2½ times as long

as the section within the pouch ; abdominal segments II and III usually with 2 hair-like setae dorsally ; abdominal segment II usually with 2 (range 1–2, average 1·7) hair-like setae ventrally, one on each side ; ante-anal region with 1–5 (average 2·5) small, circular pores . . . . . Genus ***B*** sp. (nr. ***PULVINARIA***)

– With 26–42 (average 35) fleshy dorsal head setae ; 4th antennal segment 5–7 (average 6) times longer than wide ; length of two shortest antennal bristles about half that of the fleshy setae ; prosternum reticulated ; without basisternal setae ; abdominal segment VIII with a cylindrical caudal extension ; setae of glandular pouch with the external part about $4\frac{3}{4}$–6 times as long as the section within the pouch ; abdominal segments II and III usually without hair-like setae dorsally ; abdominal segment II usually without hair-like setae ventrally ; ante-anal region without pores . . . . . ***COCCUS*** (***C. hesperidum*** L.)

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